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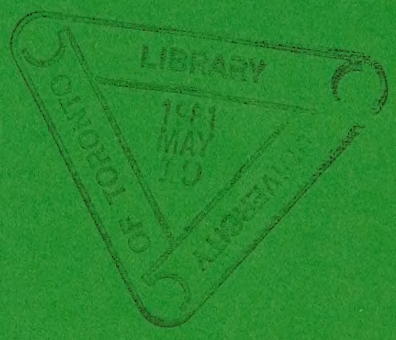
the ROYAL COMMISSION on the NORTHERN ENVIRONMENT

"THERE'S LOTS OF WAYS TO SKIN A CAT"

THE POTENTIAL CONTRIBUTION OF APPROPRIATE TECHNOLOGY TO ECONOMIC SELF-SUFFICIENCY NORTH OF 50

# Funding Program Report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ROYAL COMMISSION ON THE NORTHERN ENVIRONMENT

J.E.J. FAHLGREN, COMMISSIONER

# "THERE'S LOTS OF WAYS TO SKIN A CAT"

## THE POTENTIAL CONTRIBUTION OF APPROPRIATE TECHNOLOGY TO ECONOMIC SELF-SUFFICIENCY NORTH OF 50

by

S. F. Hunnisett, P.Eng.

March 1980

THIS PUBLICATION HAS BEEN PREPARED WITH THE FINANCIAL ASSISTANCE OF THE ROYAL COMMISSION ON THE NORTHERN ENVIRONMENT'S FUNDING PROGRAM. HOWEVER, NO OPINIONS, POSITIONS OR RECOMMENDATIONS EXPRESSED HEREIN SHOULD BE ATTRIBUTED TO THE COMMISSION; THEY ARE THOSE SOLELY OF THE AUTHOR(S).

## Acknowledgements

Many individuals and organizations assisted with this project by providing photographs, advice, information or all of the above. Some of them are in no particular order

Ontario Science Center - Toronto
Allan Vigoda/International Council for Adult Education - Toronto
Robert Mitchell/Canadian Hunger Foundation - Ottawa
Public Archives Canada - Ottawa
Algas Resources Ltd. - Calgary
Glen Milne/Nepean Development Consultants/Ottawa
Gibson Cranberry Growers - Parry Sound
Abby Smith/Ontario Craft Council - Toronto
Steve Graham - Ottawa
Goodyear Canada Ltd. - Toronto
Dave Burgess/Jacuzzi Canada Ltd. - Toronto
Jim Portree/Manitoba Department of Agriculture - Winnipeg
Big Trout Lake Furniture Shop - Big Trout Lake
Greg Rist - Toronto
Peter Mitton/Cathy Beamish - Timmins
Allan Cain/Development Workshop - Toronto/Tehran
Ministry of Culture and Recreation Resource Center - Toronto
Terraflex Ltd. - Calgary

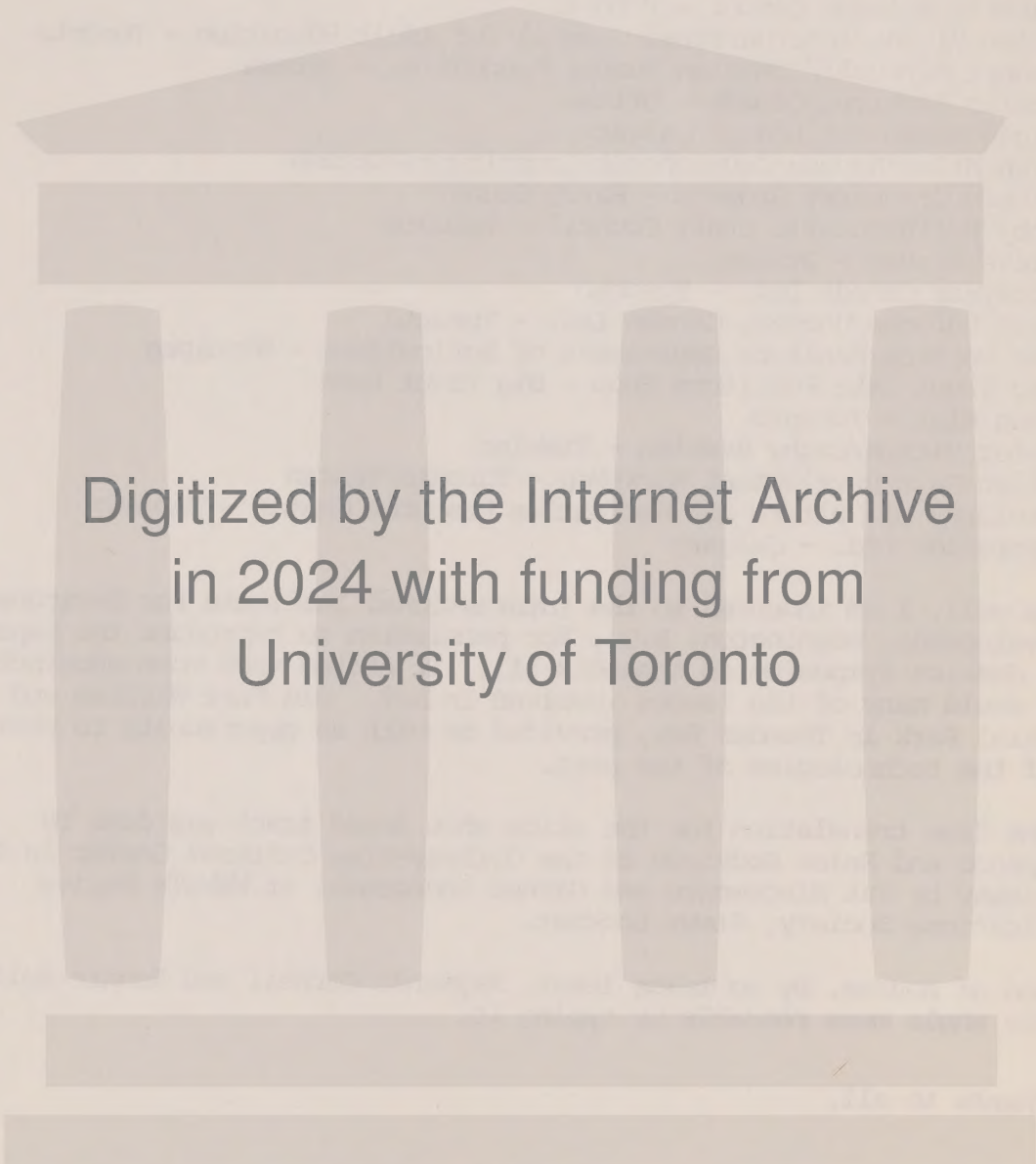
As well, I am indebted to the International Institute for Environment and Development, Washington, D.C., for permission to reproduce the Report of the Jamaica Symposium as Appendix 111. It stated much more succinctly than I could many of the issues involved in A.T. Old Fort William and Centennial Park in Thunder Bay, provided me with an opportunity to photograh many of the technologies of the past.

The Cree translation for the slide show sound track was done by Greg Spence and Helen Rodrigue at the Ojibway-Cree Cultural Center in Timmins, the Ojibway by Pat Ningewance and Garnet Angeconeb, at WaWaTa Native Communications Society, Sioux Lookout.

And of course, by no means least, Raymonde Corbeil and Bonnie Mellin made the whole mess readable by typing it.

Thanks to all.

/SH



"I think it was once when we were still living in the village on the Columbia. It was summer.....and I'm about ten years old and I'm out in front of the shack sprinkling salt on salmon for the racks behind the house, when I see a car turn off the highway and come lumbering across the ruts through the sage, towing a load of red dust behind it as solid as a string of boxcars.

"I watch the car pull up the hill and stop down a piece from our yard.....

"I know it isn't tourists with cameras because they never drive this close to the village. If they want to buy fish they buy them back at the highway; they don't come to the village because they probably think we still scalp people and burn them around a post. They don't know some of our people are lawyers in Portland, probably wouldn't believe it if I told them. In fact, one of my uncles became a real lawyer and Papa says he did it purely to prove he could, when he'd rather poke salmon in the fall than anything. Papa says if you don't watch it people will force you one way or the other, into doing what they think you should do, or into just being mule-stubborn and doing the opposite out of spite.

"The doors of the car open all at once and three people get out, two out of the front and one out of the back. They come climbing up the slope toward our village and I see the first two are men in blue suits, and the behind one, the one that got out of the back, is an old white-haired woman in an outfit so stiff and heavy it must be armor plate. They're puffing and sweating by the time they break out of the sage into our bald yard.

"The first man stops and looks the village over. He's short and round and wearing a white Stetson hat. He shakes his head at the rickety clutter of fishracks and secondhand cars and chicken coops and motorcycles and dogs.

"'Have you ever in all your born days seen the like? Have you now? I swear to heaven, have you ever?'

"He pulls off the hat and pats his red rubber ball of a head with a handkerchief, careful, like he's afraid of getting one or the other mussed up - the handkerchief or the dab of damp stringy hair.

"'Can you imagine people wanting to live this way? Tell me, John, can you?' He talks loud on account of not being used to the roar of the falls.

"John's next to him, got a thick gray mustache lifted tight up under his nose to stop out the smell of the salmon I'm working on. He's sweated down his neck and cheeks, and he's sweated clean out through the back of his blue suit. He's making notes in a book, and he keeps turning in a circle, looking at our shack, our litte garden,at Mama's red and green and yellow Saturday-night dresses drying out back on a stretch of bedcord-keeps turning till he makes a full circle and comes back to me, looks at me like he just sees me for the first time, and me not but two yards away from him. He bends toward me and squints and lifts his mustache up to his nose again like it's me stinking instead of the fish.

"'Where do you suppose his parents are?' John asks. 'Inside the house? Or out on the falls? We might as well talk this over with the man while we're out here.'

"'I, for one, am not going inside that hovel,' the fat guy says. 'That hovel,' John says through his mustache, 'is where the Chief lives, Brickenridge, the man we are here to deal with, the noble leader of these people.'

"'Deal with? Not me, not my job. They pay me to appraise, not fraternize.'

This gets a laugh out of John.

"'Yes, that's true. But someone should inform them of the government's plans.'

"'If they don't already know, they'll know soon enough.'

"'It would be very simple to go in and talk with him.'

"'Inside in that squalor? Why, I'll justbet you anything that place is acrawl with black widows. They say these'dobe shacks always house a regular civilization in the walls between the sods. And hot, lord-a-mercy, I hope to tell you. I'll wager it's a regular oven in there. Look, look how overdone little Hiawatha is here. Ho. Burnt to a fair turn, he is.'

"He laughs and dabs at his head and when the woman looks at him he stops laughing. He clears his throat and spits into the dust and then walks over and sits down in the swing Papa built for me in the juniper tree, and sits there swinging back and forth a little bit and fanning himself with his Stetson.

"What he said makes me madder the more I think about it. He and John go ahead talking about our house and village and property and what they are worth, and I get the notion they're talking about these things around me because they don't know I speak English. They are probably from the East someplace, where people don't know anything about Indians but what they see in movies. I think how ashamed they're going to be when they find out I know what they are saying.

"I let them say another thing or two about the heat and the house; then I stand up and tell the fat man, in my very best schoolbook language, that our sod house is likely to be cooler than any one of the houses in town, lots cooler! 'I know for a fact that it's cooler'n that school I go to and even cooler'n that movie house in The Dalles that advertises on that sign drawn with icicle letters that it's cool inside!'

"And I'm just about to go and tell them, how, if they'll come on in, I'll go get Papa from the scaffolds on the falls, when I see that they don't look like they'd heard me talk at all. They aren't even looking at me. The fat man is swinging back and forth, looking off down the ridge of lava to where the men are standing their places on the scaffolding in the falls, just plaid-shirted shapes in the mist from this distance. Every so often you can see somebody shoot out an arm and take a step forward like a swordfighter, and then hold up his fifteen-foot forked spear for somebody on the scaffold above him to pull off the flopping salmon. The fat guy watches the men standing in their places in the fifty-foot veil of water, and bats his eyes and grunts every time one of them makes a lunge for a salmon.

"The other two, John and the woman, are just standing. Not a one of the three acts like they heard a thing I said; in fact they're all looking off from me like they'd as soon I wasn't there at all.

"And everything stops and hangs this way for a minute.

"'I get the funniest feeling that the sun is turned up brighter than before on the three of them. Everything else looks like it usually does-the chickens fussing around in the grass on top of the'dobe houses, the grasshoppers batting from bush to bush, the flies being stirred into black clouds around the fish racks by the little kids with sage flails, just like every other summer day. Except the sun, on these three strangers is all of a sudden way the hell brighter than usual and I can see the....seams where they're put together. And, almost, see the apparatus inside them take the words I just said and try to fit the words in here and there, this place and that, and when they find the words don't have any place ready-made where they'll fit, the machinery disposes of the words like they weren't even spoken.

"The three are stock still while this goes on. Even the swing's stopped, nailed out at a slant by the sun, with the fat man petrified in it like a rubber doll. Then Papa's guinea hen wakes up in the juniper branches and sees we got strangers on the premises and goes to barking at them like a dog, and the spell breaks.

"The fat man hollers and jumps out of the swing and sidles away through the dust, holding his hat up in front of the sun so's he can see what's up there in the juniper tree making such a racket. When he sees it's nothing but a speckled chicken he spits on the ground and puts his hat on.

"'I, myself, sincerely feel,' he says, "that whatever offer we make on this....metropolis will be quite sufficient.'

"' Could be. I still think we should make some effort to speak with the Chief-'

"The old woman interrupts him by taking one ringing step forward. 'No.' This is the first thing she's said. 'No,' she says again in a way that reminds me of the Big Nurse. She lifts her eyebrows and looks the place over. Her eyes spring up like the numbers in a cash register; she's looking at Mamma's dresses hung so careful on the line, and she's nodding her head.

"'No. We don't talk with the Chief today. Not yet. I think....that I agree with Brickenridge for once. Only for a different reason. You recall the record we have shows the wife is not Indian but white? White. A woman from town. Her name is Bromden. He took her name, not she his. Oh, yes, I think if we just leave now and go back into town, and, of course, spread the word with the townspople about the government's plans so they understand the advantages of having a hydroelectric dam and a lake instead of a cluster of shacks beside a falls, then type up an offer-and mail it to the wife, you see, by mistake? I feel our job will be a great deal easier.'

" She looks off to the men on the ancient, rickety, zigzagging scaffolding that has been growing and branching out among the rocks of the falls for hundreds of years.

"' Whereas if we meet now with the husband and make some abrupt offer, we may run up against an untold amount of Navaho stubbornness and love of - I suppose we must call it home.'

"' I start to tell them he's not Navaho, but think what's the use if they don't listen? They don't care what tribe he is.

" The woman smiles and nods at both the men, a smile and a nod to each, and her eyes ring them up, and she begins to move stiffy back to their car, talking in a light, young voice.

"'As my sociology professor used to emphasize, 'There is generally one person in very situation you must never underestimate the power of.'

"'And they get back in the car and drive away, with me standing there wondering if they ever even saw me.'

-Ken Kesey, "<u>One Flew Over the Cuckoo's Nest</u>

TABLE OF CONTENTS

Volume 1 - The Technologies


| | | Page |
|---|---|---|
| 1. | Introduction | |
| 1.1 | Technology | 1 |
| 1.2 | Appropriate Technology | 1 |
| 1.3 | Indigenous Technologies | 5 |
| 1.4 | Technologies of the Past | 10 |
| 1.5 | Northern Resources and Restrictions | 11 |
| 1.6 | Terms of Reference | 13 |
| 1.7 | The Third World and the North | 15 |
| 1.8 | Software | 16 |
| 1.9 | Reflection on A.T. | |
| 2. | The Technologies | |
| 2.1 | Agriculture | |
| 2.1 | Introduction | |
| 2.1.2 | Greenhouses a) standard b) solar c) waste heat d) attached | 18 |
| 2.1.3 | Indigenous crops | 20 |
| 2.1.4 | Animals | |
| 2.1.4.1 | Animal Husbandry | 21 |
| 2.1.4.2 | Draught Animals | 22 |
| 2.1.4.3 | Animal Agriculture Technology | 22 |
| 2.2. | Housing | |
| 2.2.1 | Introduction | 23 |
| 2.2.2 | Logs | 23 |
| 2.2.3 | Stone | 24 |
| 2.2.4 | Cements | 24 |
| 2.2.5 | Soils | 25 |
| 2.2.6 | Brick | 25 |
| 2.2.7 | Grasses/Reeds | 26 |
| 2.2.8 | Insulation | 26 |
| 2.3 | Energy | |
| 2.3.1 | Introduction | 27 |
| 2.3.2 | Conservation | 27 |
| 2.3.3 | Wood Heat | 28 |
| 2.3.4 | Solar Energy | |
| 2.3.4.1 | Space Heating | 29 |
| 2.3.4.2 | Electricity Generation | 30 |

2. The Technologies (cont'd) Page


2.3.5 Electricity Generation
2.3.5.1 Small Scale Hydro 30
2.3.5.2 Zero Head Hydro 31
2.3.5.3. Wind 31
2.3.5.4 Thermal a) wood 32
b) peat
c) other fuels
d) waste heat
2.3.5.5 Wave and Tidal

2.3.6 Methane 34
2.3.7 Alcohol 35
2.3.8 Gasification 36
2.3.9 Natural Refrigeration/Freezing 36

2.4 Manufacturing and Services

2.4.1 Woodworking 37
2.4.2 Mechanical Repair 37
2.4.3 Fiberglass 38
2.4.4 Metal Working
2.4.4.1 Introduction 39
2.4.4.2 Foundries 40
2.4.4.3 Metal Working 41
2.4.5 Craft Work
2.4.5.1 Introduction 42
2.4.5.2 Fabrics and Furs 42
2.4.5.3 Ceramics 43
2.4.6 Food Processing
2.4.6.1 Bakery 43
2.4.6.2 Pop Factory 43
2.4.6.3 Brewing and Distilling 44
2.4.7 Minerals 45
2.4.8 Commercial Fishing 46

2.5 Transportation

2.5.1 Introduction 46
2.5.2 Land Transportation
2.5.2.1 Narrow Gauge Rail 47
2.5.2.2 All Terrain Vehicles 48
2.5.3 Water Transportation
2.5.3.1 Jet Boats 48
2.5.3.2 Hydrofoils 49
2.5.3.3 Sail 50
2.5.3.4 Navigational Obstructions 50
2.5.4 Air Transportation
2.5.4.1 Rigid Airships 50
2.5.5 Multiphibious Modes
2.5.5.1 Hovercraft 51
2.5.5.2 Air Cushion Landing System 51

3. Conclusion 52

Volume II - The Project


| Work Program Chronology | | Page |
|---|---|---|
| 1. | In the Beginning | 53 |
| 2. | The Audio-Visual Presentation | 56 |
| 3. | The Report | 60 |
| 4. | Liaison with other groups | 60 |
| 5. | Community visits | 60 |
| | 5.1 Introduction | 60 |
| | 5.2 Community visit log | 62 |
| 6. | Conslusion | 69 |
| 7. | Recommendations | 69 |


Appendices


I The Audio-Visual Presention
II Letter of Agreement
III Report of the Jamaica Symposium, "Mobilizing Technology for World Development"
IV Magazine Article, "Let them eat missionaries"
V Newspaper article, "Incentives felt needed in innovation process"

VOLUME I

# THE TECHNOLOGIES

# 1. INTRODUCTION

## 1. 1 Technology

For the purpose of this report, technology will be defined as the application of science and innovation to the solution of human problems. The application of science may not be obvious; the technological process may appear to be as much art as science. A well know example is the ritual of the making of a Japanese Samurai sword. While the maker may not realize it, he is carrying out a sophisticated heat treatment and forging process identical in method to that used in modern industry. Whether obvious, or not, the element of scientific application is essential to technology.

Technology usually, but not necessarily, involves the use of some hardware such as a tool, machine, vehicle or structure. An exception might be breeding of a plant or animal more suited to certain conditions. While this process is scientific and could be classed as technology, no hardware need be used directly.

Technology also usually involves the use of an outside energy source. Traditionally this was human or animal power. Now it is more likely (primarily) fossil fuel, wood or solar energy or (secondarily) electricity or steam. In fact, so central is the use of energy in technology that it will receive special attention as a topic of its own.

## 1.2. Appropriate Technology

Modern Technology has available to it a wide range of methods of analysis and manufacture, so that any given technological problem can be solved in a large number of ways.

An example might be water supply. Man requires water to live. If he wishes to live in a warm climate near a surface water source he might do so with no technology whatever. He could simply put his mouth to the surface, or cup his hands, to drink and he need only jump in to bathe. Boiling his food or preparing hot drinks would only be possible if he had access to a natural source such as a hot spring. If, however, he wishes to live in a climate where surface sources freeze or his lifestyle dictates extensive cooking or living remote from a surface source, he will have to apply some science and innovation to the solution of this human problem: moving water from its natural location to the location where it is required.

Consider the possibilities. He could find a new source such as a plant, a well, or rain water. He could move the source by damming or diverting a river. Finally, he could move just the amount of water needed from source to point of consumption.

The latter is the most common. Let us consider further the possible methods. He could use any sort of container from a bark pot through metal or plastic pails carried by hand or wagon to a tank drawn by hand, animals or a vehicle. He could also build a fixed distribution system such as ditches or pipes, natural or manufactured. This type of system usually involves some type of pump and could supply all points of consumption or only several public taps.

Any one of the above systems is capable of solving the problem at hand, moving water. However, each may confer certain other benefits such as low initial cost, low operating cost, reliability, convenience, health, etc.. Each system will incur certain costs in its construction and operation: money, labour, local materials, imported materials, know-how, skills, etc.

If hauling water has a social aspect in a given society, a piped system will remove that aspect.

If certain individuals in the society derive income from delivering water, a central piped system will deprive them of that income but the cost of the piped system must be borne by someone. There is not likely to be a great impact on the physical environmental from any of the systems except, possibly, the effects of vehicles or construction. On the other hand, increased water supply may lead to improved health, so impacts may be positive or negative.

It is obvious from the above analysis that, of the variety of systems available, only one will be most appropriate for any given environment. For example, a highly centralized buried piped system makes a lot of sense in Toronto. Fort Severn, however, is much different place, although both are in the Province of Ontario. Fort Severn's population of 250 lives in houses spaced relatively distant from one another. The climate is cold with permafrost under most of the community. Energy and materials imported from the south are expensive and minimal repair facilities are available locally. It is highly unlikely that the system which is "best" for Toronto would be "best" for Fort Severn.

The realization of this fact and observations in the Third World have led to the concept of Appropriate Technology. The Third World (which has many similarities to North of 50) discovered, as did Ontario's Northerners, that transplanting a technology developed for one environment into another environment often caused more problems that it solved. Thus was born the Appropriate Technology movement which is currently enjoying much popularity in Third World Economic Development circles. There is also much realization that the over-developed countries could use some appropriate technology as well.

It has been my observation that great potential benefits could be derived from the "appropriatization" of technology in the North.

Where decisions are made in the South, which is the case in virtually all of the remote communities and other areas as well, technology has a distinct southern flare. Where northerners are on their own, such as in wild rice harvesting, they tend to work out appropriate solutions themselves. However, it has also appeared to me that many northerners are not aware of the range of alternatives available to them.

Before closing this section, let me comment on Intermediate Technology which is often confused with Appropriate Technology. Often what is required in the Third World is a technology somewhere between the simple traditional one (hauling water in clay pots) and the "modern" (centralized, piped water). This technology is called Intermediate and examples would be a hand cart or animal drawn tank. In the North, the Intermediate Technology may be the most appropriate, but we may also find that the simple or modern technology may suit better. Appropriate Technology means appropriate technology, not necessarily Intermediate Technology or anything else.

## 1. 3 Indigenous Technology

Modern man tends to be overly impressed by his complex technology. It seems a little ironic, however, that the vast majority of modern people who haven't a clue what "their own" technology is about look down on the "primitive" technologies of indigenous peoples. The traditional technologies are not at all primitve, however.

The traditional Indian technology of Northern Ontario was a case on point. I personally have carried out engineering tests on snowshoes and studied some other items such as canoes. I can say without doubt that there is nothing primitive about these technological devices. The snowshoes design is highly optimized from both a performance and structural viewpoint. The canoe exhibits many of the structural principles used in modern aircraft and bridges such as stressed-skin construction and prestressing. I think that the telling fact on the traditional technology is that these items, canoes and snowshoes, are still very much in use and our fancy modern technology has not been able to substantially improve upon their design.

As well, the traditional technology was most appropriate. It was wholly integrated into the society and, in fact, without it, as in the modern case, life itself in the North would not have been possible. It used local renewable resources with minimal damage to the environment. Its major hallmark was its availability to all who required it. Can you imagine each modern family building its own house, car, appliances and even the tools to make them using only what they find around them?

So it is for many indigenous technologies - as shown by the quotation given from "One Flew Over the Cuckoo's Nest". Yet, all over the world, indigenous people are falling all over themselves to abandon their traditional technologies in favour of joining the Pepsi generation.

The Development Workshop is an international group of architects operating in the Middle East, adapting traditional building designs methods, and materials to modern use. They have stated the case most succinctly in their exhibition "Indigenous Building and the Third World":

"The potentials of indigenous systems have been neglected in most Third World countries. Instead they have been replaced by Western methods often inappropriate to local conditions and needs - physical, economic, social, cultural and aesthetic. The visible material success of the Western industrialized world has made it the obvious model for Third World countries. The very term 'developing countries' implies a correlative 'developed' world which would act as an ideal. Over the years, the values, objectives and methods of the West have been adopted by the other countries through a combination of imposition and emulation. The British model of parliamentary government has been implanted intact into countries with very different indigenous political organisations. Western medical methods have been unquestioningly applied, often to the complete neglect of long-practiced local methods of healing.

"Today there is a growing awareness that such literal transference of methods rarely works. Nor is it adequate to start with basically Western objectives and methods and then modify them to local conditions: The Third World has very different social, cultural and economic bases (and in most cases, different physical environments as well).

"Furthermore, in the global context of political economy, the Third World is now in a very different position from that in which the Western World developed, when it had the rest of the world to draw its resources from. Yet today the Western world itself is beginning to have grave doubts about the validity of its own socio-economic models. Profligate consumption of energy and resources has precipitated the energy crisis and aggravated a major economic recession. Over-specialisation and institutionalisation have taken control out of the hands of the majority of the population and left them alienated. Moreover at the time that the Western world was developing, it was concurrently shaping the socio-economic systems of the rest of the world, often to its own advantage and to the detriment of the country in which it was acting. Much of what is considered 'modern' today in a developing country was fathered by this shaping process and continues to work to the detriment of the country. However, amongst the many inappropriate imported models, those indigenous systems that were, through neglect least affected by this shaping process may now paradoxically have the most to teach us. Many of the indigenous systems remain relevant to local needs, are based on low and local use of energy and resources, and work in harmony with the natural environment.

"For an example that illustrates the above points, let us consider housing. An old Arab saying loosely translates as 'The day you stop building your house you will die'. This is not some mystical quote but factually reflects the indigenous system of housing. In Salala, Southern Oman, the occupant of an old town house, whose family had lived there for generations, described to us how his house had been built. The house had started as one room on the plot of land and had gradually been added to as family size and fortunes increased, until it reached its present three-storey courtyard shape. And today on the top floor yet another room had been built, and a second room, still in timber and corrugated iron, was soon to be converted into more permanent materials so as to house a new arrival in the family. In the recently allotted plots in the town the same process could be observed.

The new arrivals lived in a tent whilst building their first limestone room; the longer established houseowners had already inscribed a courtyard on the ground floor and were making further additions.

"Thus, to paraphrase John Turner's words, the indigenous system of housing is one in which it is very much a process, intimately related to the users' needs and finances, and very much in the users' control. The idea of housing being the production and distribution of a number of units by the government or a private institution to a passive, recipient population is one of the misleading models set up by Western countries. Today, with chronic and increasing housing shortages in the wealthiest industrialized nations, people like John Turner are saying that the idea of housing as a 'product' is unworkable. Instead they are turning to the housing 'processes' found in the indigenous systems of the Third World to draw lessons for their own countries. Meanwhile in developing countries, housing as a product continues to be sold as the most modern idea, along with a whole range of other dubious ideas on design, construction and building types. Thus as Western architects begin to realise the damaging social costs of high-rise apartment living, they become a major feature in many Third World countries.

"The successful selling of Western ideas depends on the assumption fostered in people in developing countries that Western methods are superior to their own. Perhaps the most insidious effect has been their loss of self-respect and identity. In Oman, when we asked a ten year old school boy (with just two years formal schooling) to draw his own flat-roofed mud-brick, courtyard house, he drew us a pitched-roof Western bungalow with a front garden. He drew his family and himself in shirts and trousers, although in reality he was still dressed in the traditional galabeya.

"The situation, however, can be reversed. Another owner-occupant. of a mud-brick and palm-stem house in Oman told us he would like to live in a concrete house, indicating a bunker-like room near him. But after he had taken us through his own house and explained the rationale behind the use of the different materials and rooms and how they performed in his environment, he changed his mind about the concrete room. He preferred his own house, but asked if the permanence of the materials could be improved.

"It is often the educated professionals and policy-makers of Third World countries who are the most convinced of the superiority of models offered by the Western countries. Their training and education is too frequently limited to these Western models. Since the majority of their people are still operating within indigenous systems, it is the professionals who are alienated in their outlook and in what they can offer. A re-evaluation of their own countries' indigenous systems would not only help these professionals regain their self-respect and identity, but also realign them with their own people and equip them better to be of service. In China, medical professionals seriously re-evaluated the ancient indigenous system of acupuncture, so that today it largely replaces Western anaestetics. The Ujamaa village council of Tanzania was derived from the indigenous tribal organisation and it now forms a basic political unit of the country.

"By 'the indigenous built environment' we mean the built-environment of the rural areas, the older traditional sections of the cities, and to an extent the unofficial settlements (such as squatter settlements) of the newly urbanising areas in the Third World. It is in these areas that the traditional methods of building and design are most apparent. That they are often also the most run-down areas is more to do with wider economic conditions such as over-crowding, poverty and neglect than with the traditional methods themselves."

- "INDIGENOUS BUILDING AND THE THIRD WORLD"

- The development workshop, TEHRAN, IRAN

Modern technology does not have the corner on innovation or ingenuity. In fact, the reverse may be true. Indigenous technologies are generally developed over a long period of time by innovation and trial-and-error. The modern technologist, however, has such a wide range of standard hardware available that there is a strong dis-incentive for him to move away from standard solutions. A good example is electricity generation. The ready, off-the-shelf availability of inexpensive gasoline and diesel powered generators has led to their almost exclusive installation in the north. They are so easy to obtain and install that the technologist must have a great deal of motivation to look at other alternatives. This situation may therefore have seriously impeded economic and community development in the North.

I know from my own experience, that education, as well, may actually inhibit innovation. During my training as an engineer, I learned a great deal about analysis of existing systems but almost nothing about synthesis of new systems. All this emphasis on existing methods tends to narrow one's view with respect to new methods and ideas.

It is not the intention of this section to prove that traditional technologies are superior to the modern - only that the traditional are not necessarily as "primitive" as "modern" people might think.

And surely, a people who are able to develop a traditional technology under the rather difficult circumstances of the past are able to take today what the traditional and the modern offer and synthesize something appropriate.

## 1. 4 Technologies of The Past

Many of the technologies of the past died because something "better" came along. For example, many types of cement used in the past were abandoned on the invention of portland cement whose chief advantage is that it will set under water. Many technologies however, died not of lack of viability, but due to lack of appropriateness.

Cheap, unlimited supplies of fossil fuels improved the appropriateness of other more energy intensive or more convenient technologies. For instance, tractors replaced animals. This did not increase per acre yields but did improve farm economics. The inefficient steam engine was replaced by the more efficient and convenient diesel-electric set in railroad use, at a penalty of requiring a specialized, non-renewable fuel.

However, supplies of fossil fuels are no longer unlimited and no longer cheap. In many parts of the north, they never were. So it behooves us to re-examine some of the bygone technologies such as the above mentioned examples. I understand that the cost of fuels, chemical fertilizers and machinery have escalated to the point where the economics of animal powered organic agriculture have become competitive, even in the south. The steam engine, as well, while it is not terribly efficient, can burn a wide range of fuels, some of which are available locally. This was the case with Mississipi river boats which cut their fuel along the banks and, if necessary, even burned the boat! Modern technology can also offer improvements to the steam engine.

Some of the technologies presented here, then, will be those from the past which have been abandoned due to chaging conditions. However, the original conditions may, at least in part, still exist in the north.

## 1. 5 Northern Resources and Restrictions

Northerners have access to what, in a resource hungry world, can only be called embarrassing riches. This is not to say that they could join OPEC or a potash cartel; nor that there are not serious problems to be faced in their resource development.

However let us begin by cataloging some of these resources:

- human: unused and underused skills, abilities and labour
- food and agriculture
  - land
  - fur bearing and food animals
  - migratory and non-migratory birds
  - fish
  - indigenous food and medicinal plants and berries
- minerals
  - base and precious metals
  - uranium (possibly a mixed blessing)
  - various rock types, fossils, semi-precious stones, etc. clays, gravels, etc.
- energy sources
  - falling and flowing water
  - wind
  - wood
  - peat, lignite
  - abundant sun light
  - cold weather
- miscellaneous
  - timber
  - clean water
  - extensive waterways
  - plenty of "open space", wilderness

Anyone who comments that a community situated in the midst of this "veritable cornucopia" has no reason for existing simply must have his eyes closed.

There are, however, certain problems which make development of these resources difficult:

- large area, sparse population
- lack of capital resources
- lack of skills, education and self-confidence
- control of resources by outsiders
- cold weather

The reader will note that some items appear on both lists. Climate for example, may be a help or a hindrance depending on the task at hand. (e.g. refrigeration, freezing, transportation, agriculture)

There are several questions about the development of these resources which are central to the Commission's mandate. It is beyond the scope of this report to attempt to deal with them but they will be mentioned so that the reader may keep them in mind while he peruses this report:

1. Who should control northern resources?
2. Who should benefit from the development of northern resources?
3. Who should pay the costs-social, enrironmental, economic - of northern resource development?
4. Should northerners be "hewers of wood and drawers of water" supplying raw resources to others? What role should northerners play in processing of their resources?
5. Should the goal in non-renewable resource development be maximum profit in the shortest time or should resources be banked until they can be put to their most productive use?
6. Even were they to completely denude themselves of their resources, could northerners satisfy the appetites of more profligate users elsewhere?

## 1.6. Terms of Reference

I have established certain ground rules for this project. These will be discussed below.

1. My main goal is to, as necessary, introduce or reinforce the idea that, given appropriate technology, there are sorts of possibilities for economic development in the north. This will be done largely by example.

2. Further goals are:
   - generate a discussion among northerners of the A.T. concept and how it might apply to their communities.
   - to record all of the above in the public domain.

3. Economic Development is treated essentially as a problem in the balance of payments. Any process which tends to reduce the outflow of cash from or increase the inflow to a community is a positive economic development process. This is a somewhat simplistic approach as it ignores such things as capital formation, entrepreneurship, infrastructure and social factors. It does, however, provide a framework for organizing specific examples.

4. Appropriate technology is where you find it. I have drawn on many sources:
   - indigenous and past technologies
   - alternative energy
   - third world and other northern areas
   - modern technology

5. Most people are at least somewhat conservative and tend to view new ideas with scepticism.

The "farther out" an idea, the greater the sceptism. Yet we know that the standard methods in the North are not working. New methods cannot do any worse. Nonetheless, in order to blunt criticism of the "that'll never work" sort, I have purposely stuck to technologies which <u>are</u> presently working somewhere or <u>did</u> work somewhere in the past. It is also difficult to obtain pictures non-existant technologies! Of course, northern examples are chosen wherever possible.

6. Emphasis has been placed on "alternatives" as the standard methods already have sufficient proponents and receive adequate attention. This is not to say that there is not a place for standard methods scale resource exploitation.

7. Two media are used. This written report is submitted as it allows matters to be dealt within some detail. However, written materials are limited in their effectiveness in communicating with the general public. In my experience, this has been especially the case in dealings with Indian people. Therefore, a slide show has been prepared to accompany this report.

8. The following criteria were applied in choosing technologies:
    1. Amenability to local control
    2. Accessibility to all members of the community, not just an elite
    3. Use of local resources
    4. Minimization of negative impacts on environments - physical, economic, social. Hopefully, any technologies chosen would strengthen a community's social fabric.

It may not be possible to meet all these criteria - e.g. almost any project has some negative environmental impact. However, I have tried to get a relatively close fit to the criteria.

The essence of appropriate technology is its local nature. It works in the framework of local environments, fits into local priorities and uses, as much as possible, local resources. Experience has proven that this cannot happen without local control. Whether technology or education, health care, administration or anything else, outside (i.e. southern) control of decision - making will virtually guarantee inappropriateness. In the light of these factors, no attempt has been made to determine the feasibility or appropriateness of specific technologies. Each case must be considered separately. I have chosen technologies which I believe have good potential in the North but it is the prerogative of Northerners and Northerners alone, in their own communities, to determine feasibility and appropriateness.

## 1.7. The Third World and The North

NOTE: The following comments are particularly applicable to the "Indian" parts of the north where most of my northern experience has been gained.

The reader will have already noted frequent references to the Third World. While I have no experience in the Third World, I have spoken to several workers who have worked both there and in the North. They tell me that the parallels are striking. Both have colonial histories featuring the meeting of a simple, land-based society with a complex, industrial European society. The European society eventually dominated and imposed its language, lifestyle and values on the indigenous. The result is a people who are demoralized. Racial discrimination usually leads to the Europeans occupying the upper rungs on the social and economic ladder and the indigenous people the lower.

The presents are also similar. Control may still rest largely with one racial or social group to the detriment of the masses. "Foreign" aid is provided by the wealthier groups more as a matter of conscience than a serious attempt to reorder the world's economics.

There are also certain very marked differences between the areas. It is said that the mosquito and the tse-tse fly saved Africa for the black people. Lack of heavy white immigration has made it possible for them to regain control of their lands, such as remains of them, where no such possibility exists for the Americas' indigenous people. The North is also free of the grinding poverty and persistent starvation that characterises much of the Third World. Few Third World groups have access to the large sums of money that groups occasionally receive from government. (It could be argued however, that the North might be better off without some of those "many - strings attached" funds.) There is also a higher level of education in the north where, for instance, the germ theory of disease is widely accepted.

Differences notwithstanding, the similarities are striking. Anyone who is concerned with appropriate technology and processes of development in the North would do well to study the Third World.

## 1. 8. Software

Technical people, such as myself, tend to get excited about the technologies to the exclusion of all else. This is not surprising as this is where our interests and expertise lay.

However, while the technologies are important, they cannot operate in a vacuum. Without appropriate (!) back-up systems and infrastructure, they are doomed to failure. That is to say, turn-key projects, parachuted into communities without the necessary systems to back them up, will not work. Period.

Many systems are needed. Since appropriate technology must arise from within a society, the most important system is that of innovation and entrepreneurship. Where that system is weak, the latent ingenuity and entrepreneurial abilities present in any society must be reinforced. This may mean a lot of concrete things like access to venture capital, training, education, etc. but it also depends on the societies' and individuals' self-images and confidence in their own abilities. It has been my observation that this is a problem not only in the North but also in all of Canada and is part of the reason that Americans own this country. They simply believe that there is nothing they cannot do, so, whilst we wring our hands, they go out and "do it".

Local control of technology does not mean that it all must arise locally. Every society borrows what it can from others. The essential ingredient is the decision - making process. At least some key members of the society must have the knowledge and ability to assess the available options, make choices, and direct any outside experts who do the "dirty work".

## 1. 9. Reflection on A.T.

I think the reader can easily conclude that the introduction and application of Appropriate Technology is not simply a matter of dropping a few smart ideas in the right laps. While the technologies themselves may be simple (and often are, at the same time, sophisticated) and available, introducing them to any given society with any degree of success is a more difficult process that must be carried out essentially by people themselves, for themselves. Governments and other agencies can only help by providing support rather than restricting or trying to control.

## 2. The Technologies

### 2.1 Agriculture

#### 2.1.1 Introduction

Parallel to this project is another being prepared on northern agriculture. Those preparing that report are far better qualified than I, so I would not hope to outguess them. I do feel, however, for the sake of completeness that I should mention some possibilities with emphasis on the technology.

The basic necessities of life are food, shelter and clothing. All three areas will be covered in this report, as well as many others. Self-sufficiency begins with home production of necessities, the most basic of which is food.

No one will hold out the view that Northern Ontario is an agricultural haven. In fact, the difficulties posed in producing quantities of food in the north offer wide scope for innovation and science.

However, the situation is far from impossible. Root crops have been grown for centuries and the fur trading companies raised animals throughout the North. While summers are short, days are long and annual hours of sunlight are high. While a dearth of prime land exists, there is plenty of land and such ingredients as peat, limestone, sawdust and wood ashes to modify and improve its characteristics. Experience with agriculture in places like the Yukon has lead to development of new varieties of plants and animals particularly suited to northern agriculture.

Let us, then, look at a few of the possible technologies.

#### 2.1.2. Greenhouses

Where the climate is a problem, one approach is to create an artificial climate. This may be relatively simple where, as is often the case, it is only necessary to protect against a few "killer" frosts. In this case plastic covers, smudge pots, etc. may be required. For multiple cropping or crops which require a longer term altered climate, a more extensive artificial environment is required.

a) Standard Greehouses

The standard greenhouse was invented for use in the low countries of Europe. Not surprisingly, it has certain problems for use in the North, largely high heat loss from large areas of glass, not to mention the cost thereof. An adaption of the standard greenhouse for the North becomes what is known as the solar greenhouse.

b) Solar Greenhouses

All greenhouses are solar greenhouses, but the solar greenhouse attempts to maximize the heat input of the sum and reduce the other heat input required. This includes features like insulation of the north wall and foundation, double or triple glazing, moveable insulation of glazed surfaces and foundations, and massive structure or water tanks for heat storage.

The New Alchemist's Ark greenhouse in Prince Edward Island uses all of these features plus an air handling system to move excess heat in and out of a rock storage. While P.E.I.'s climate is not as severe as northern Ontario's, the solar system does provide virtually all the heat required for year-round operation of the greenhouse. As well, the water tanks are used for raising fish and the fish farming and horticuture systems are ecologically integrated.

c) Waste Heat Greenhouses

Where waste heat is available, it can be used to heat greenhouses. Algas Resources Ltd. have built a greenhouse using the waste heat from a Trans Canada Pipeline compressor station in Saskatchewan. This station has had good results growing crops such as tomatoes year round. Hot engine exhaust is injected between the two glazing layers of polyethylene which not only allows growth right up to the glazing but also allows CO2 (but not harmful gases) to enrich the atmosphere in the greenhouse. The design is relatively standard and heat loss is undoubtedly "high," but plenty of "free" heat is available.

The Trans Canada Pipeline also passes through the southern fringe of Northern Ontario and I am told that Northern College presently has underway at Ramore a project similar to Algas'.

There are many other sources of waste heat throughout the north such as diesel generators, paper mills, thermal power stations, etc. This waste heat could be used not only for greenhouses but also for heating buildings (district heat) or water for laundry or industrial processes, drying lumber, bricks, firewood, etc. or doing any other job requiring low temperature heat.

d) Attached Greenhouses

The greenhouse can be attached to a house or other building, preferably as a "lean-to" on the south side. Since it is essentially a solar collector, it can actually collect more heat than it uses and contribute to the heat requirements of the bulding. Fisher and Yanda, authors of "The Food and Heat Producing Greenhouse" have worked in New Mexico, parts of which have a climate not much less severe then Northern Ontario. They report that one square foot of greenhouse can heat two square feet of house.

2.1.3 Indigenous Crops

Already the northern climate and land are suitable for many crops because they grow wild. As a white person, I recognize the value of raspberries, blueberries, cranberries and saskatoons (?) which grow presently. Indian society would recognize many more such as herbs, teas and medicinal plants. I am not sure how the "Indian" plants could be used but the berries could be cultivated or just picked. Thereafter they could be processed or simply sold as is for the local or export market.

An example of this process is the Gibson Cranberry Marsh on the Gibson Indian Reserve near Parry Sound in southern Ontario. A muskeg was cleared, roads built and simple dams installed to control water levels. The marsh is flooded for harvest - a floating beater loosens berries and they float to the surface for collection. The marsh is flooded again just before winter and allowed to form a few inches of ice. Water levels are then lowered and the ice collapsed for the winter.

So, while the operation provides most employment for about two weeks at harvest time, it does provide two year-round jobs.

The technology employed in the harvesting operation, except, possibly, for the "beaters", is relatively standard farm fare-tractors, wagons, buildings, etc. The processing technology looks quite simple-conveyors, visual sorting, etc. but actually is quite sophistocated and was developed specifically for this processing facility which dries water off the berries and sorts them. They are sold in the south for processing to jellies, juices, etc..

### 2.1.4 Animals

#### 2.1.4.1 Animal Husbandry

Land, used in agriculture, is an asset used to produce food. In standard modern agriculture land is used to turn vast quantities of fossil fuels and synthetic fertilizers into food, a process which is very hard on the land. Land which is not suitable for horticulture can, however, be successfully dedicated to animal husbandry. Animals can also provide much valuable fertilizer and other by-products which can be input to the horticulture process. Several possibilities present themselves:

a) Standard Animals. These include cattle, sheep, pigs, chickens, ducks, and geese. Nothing more need be said than that the Hudsons' Bay and Northwest companies were raising them in the North as a matter of course. They could provide meat, dairy products, hides, furs and down.

b) Goats. These probably come under the above item but seem well suited to the North. They are hardy, easily cared for and can forage year round, even on evergreens. They can supply high quality dairy products, and angoras can provide wool. In some places, goat meat is eaten.

c) Indigenous Animals. These include fur bearers and fish which could be raised for food, fur and/or feed for other animals.

d) Northern Animals. These include reindeer (caribou?) which are successfully herded throughout northern Europe and buffalo and cattalo/beefalo which are being raised with some success in Canada at present.

2.1.4.2. Draught Animals

Costs of fuels and fertilizers are causing farmers even in the south to re-examine the economics of draught animals. A return to the mixed farm with draught animals and organic basis rather than the single crop modern system should also be examined for its applicability to the north. Draught animals can also do many other tasks such as skidding in the bush, hauling sleighs and wagons, earthmoving, etc. when not farming.

2.1.4.3. Animal Agriculture Technology

There are several appeals to animal powered agriculture:

a) Rather than just wearing out, rusting out, etc., animals reproduce themselves.

b) They burn local fuels and can assist in their production. I believe a rule of thumb was that a farmer should dedicate 1/3 of his acreage to feed. However, in the north some wild crops could contribute to feed.

c) Maintenance and repair problems are simpler than with complex equipment. On the other hand, "you don't have to shoot a tractor if it gets a flat tire".

d) Animals produce valuable fertilizers.

e) Animal agriculture is slower paced and quieter than powered agriculture, allowing the farmer a closer relationship with his land, his animals, and the process.

f) Probably the most interesting advantage is the simplicity of the accompanying equipment. Much of it can be built by the farmer or in local industries - e.g. wagons, sleighs, ploughs, etc. Since a significant portion of world agriculture is animal - powered some useful equipment is still available. Touring the countryside will also convince the tourist that much abandoned equipment exists in various states of repair/disrepair.

On the other hand, there <u>are</u> disadvantages:

a) Someone must be available to care for animals when they require care which may not be between the hours of 9 and 5, Monday to Friday.

b) Some "repair" (i.e. medical and vetrinary services) will be required.

c) While engines do not increase the productivity of land, they do decrease the labour input. In an area of high unemployment, this could actually be a disadvantage, however.

## 2.2. Housing

### 2.2.1 Introduction

There is much discussion extant on the quality of northern housing but, because of the present restriction to matters of economic development, we will not deal directly with quality of housing. That is not to say that technology cannot make major contributions to the quality of housing in the north: on the contrary the potential is great. But it is beyond the scope of this project. There are, however, at least three important aspects of housing quality which bear on economic development: use of local materials, longevity, and energy consumption. Therefore, while considerations of comfort, health and quality are important in themselves, they will be considered in this project only "insofar as" they are by-products of the economic development process.

The emphasis in this section will be on use of durable local materials while energy consumption matters will be covered in section 3.

### 2.2.2. Logs

There is nothing new about using logs to build houses in the North. In fact, given that trees are the North's most abundant resource, it is strange that we ever got out of log building in the first place.

The trend is back to logs, so I do not intend to promote them. In fact, while logs have real structural value. I feel that they are often over-rated in their insulation value. Wood generally has an R-value of about 1 per inch. A wall made from 8" diameter logs would have an average R-value of about 6 compared to the 12 or so for a 2x4 wall with fiberglas insulation. Much care must also be taken to seal log walls to avoid problems with infiltration and/or moisture. Since large logs are not easily available in the North, some attention must be paid to thermal questions.

Stackwall is one solution. By piling the logs like cordwood, any diameter may be used and walls may be as thick as desired. A further possibility would be double stack-walls with "tie logs" every few "courses" like solid brick construction. The space could be filled with insulation. The University of Manitoba is doing considerable research on stackwall.

There are possible technological inputs which could improve thermal characteristics like splitting/sawing the logs and spacing them with insulation. Design details such as splitting and staggering the logs could improve productivity, if that is desired. Small scale mechanization (beyond the chain saw and saw mill) could also improve productivity by match-grooving logs or other methods.

### 2.2.3 Stone

The use of stone as a building material needs no further comment than to note that some of man's most enduring and impressive structures are made of it. The north generally has easy access to a wide variety of rock types (igneous and sedimentary) and sizes (sand gravel, cobbles, boulders, bedrock), depending upon location.

Stone's almost unmatched ability to withstand water and freezing makes it particularity well suited to foundation construction, a common weak point in present northern housing.

### 2.2.4 Cements

Concrete is made by mixing cement, gravel and water. Mortar, that which holds bricks and stone together (or more properly, holds them apart), is made by mixing sand and masonry cement. Cement is a very dense material. Even though it is mixed with several parts gravel or sand to one part cement, the cost of transportation makes it a luxuary in the remote communities.

The technology of making cement is not complex; man has been making it for thousands of years. The present technology is based upon portland cement, a hydraulic cement which is one able to harden under water. Its main ingredients are limestone, clay and fuel, all of which are available, at least in the small quantities needed for local consumption throughout much of the North. There are also other formulations available - the Romans made a hydraulic cement from slaked lime and volcanic ash and some countries use sea shells - and a hydraulic cement is not always needed. A simpler cement could be substituted in cases where it is not required - for example in interior applications.

At present as in many industries, cements are made on a large scale but experience in the third world has shown that there is not necessarily an economy of mass production in cement. Transportation costs in the north will amplify the situation.

### 2.2.5. Soils

A variety of soils may be used in structural applications. Adobe, a simple dried clay brick, joined if required by mud "mortar" has been used successfully in many areas for centuries. It may even provide an improved mortar for stackwall construction by virtue of its greater elasticity than cement mortar. The problem with adobe is its low ability to withstand freezing thawing and/or water. However, it may well provide a useful material in the right applications.

Soil cement is the next step up the ladder. Soil cement blocks are made by ramming a mixture of sand, clay and a binder into a mold. Rammed earth blocks are similar but delete the binder. The binder may be cement, asphalt or another, depending upon what is available. Blocks are often made to interlock without mortar.

Considerable success has been encountered with rammed earth and soil cements in the third world. The equipment is simple and inexpensive, the process labour intensive.

### 2.2.6. Brick

Brick and tiles are made very simply by drying and firing a suitable clay. The clay cannot be too fussy, nor can the process, as I have made several low quality bricks in the North simply by moulding lumps of any available clay and firing them in a woodstove.

The actual industrial process is not much more complex. Suitable clay (which is available in much of the north) is dug and, if necessary, mixed with sand and/or water. It is then moulded into the bricks and allowed to dry. For firing, the bricks may be placed in a permanent kiln or simply stacked loosely and covered with mud. Firing can be done by any suitable fuel including wood and may take up to several days.

Bricks are very durable building materials but must be specially treated for horizontal applications where subject to water and freezing. A good deal of success has also been achieved in the third world with small scale brick making.

### 2.2.7 Grasses

Grass roofed mud huts are generally considered the epitome of primitive housing. We looked at the mud in the last section: let us now consider grasses. Grasses may be used, and are used, in two forms: hay and sod.

Sods have been used as building blocks, notably on the Canadian praries but sod is usually used as a roofing material. It can provide insulation in both winter and summer but is especially suited to cooling in the summer by evaporation from the grass.

Thatch, contrary to the stereotype, is a high performance roofing material. A major advantage is longevity - of the order of 70 years. Thatch is also virtually fireproof and vermin proof and provides insulation of about R30. Many grasses may be used, but water reeds, plentiful in the North, are the most desirable. Thatch is, however, labour intensive and requires a high level of skill.

### 2.2.8 Insualtion

The most common insulation material is air. All home insulation and virtually all other insulation materials use it as the "active ingredient". Exceptions are the wet suit which uses water and the thermos bottle which uses nothing - a vacuum. Unfortunately, however, air tends to move around, carrying heat with it. The "insulation" material serves mainly to isolate small pockets of air without being too conductive itself. Any "light" material, then, can serve as insulation.

Several come to mind. Greg Allen, a Kingston area architect has had some success encasing hay bales in concrete. The Soviet Union manufactures an insulating board from peat. Most natural insulation materials like hay, peat, leaves, boughs etc.. are susceptible to fire and/or vermin. Both problems may be combatted by chemical treatments (e.g. lime for vermin) or by design (e.g. encapsulation).

## 2.3. Energy

### 2.3.1 Introdution

Engergy imported to the north is very expensive and its availability and cost is often a major impediment to economic development. Yet there are many locally available sources, some simple, some sophisticated, which could be tapped or extended to supply local needs.

Because of climate and sparse population together with a high standard of living, Canadians are the world's greatest per capita energy consumers. Although many northerners do not enjoy this high standard of living, they do experience the problems of climate and remoteness. Since we are not generally considering large-scale energy intensive industries in this report, attention will be focussed on the problems of space heating and transportation. Electricity generation will also receive some attention as it is particularly useful for certain tasks such as lighting and operating electronic devices and motorized equipment. Electricity, however, is not a primary energy source but is more a means of transporting evergy, being itself produced by conversion from other forms such as heat or mechanical energy.

### 2.3.2. Conservation

Most studies on energy have shown that the cheapest source is conservation. Since the major consumers are space heating and transportation, these should and will receive the major attention here. The thrust of this report is on use of local materials which, by definition, will reduce the need for transportation, and the transportation section of this report will cover forms which may be more efficient in use of imported fuels than present forms or amenable to operation on local fuels. That leaves space heating conservation or building design for this section.

Most Canadian buildings, and we will concentrate here on houses, are inappropriate to Canadian conditions. They were designed for ranches in Texas where they may (or may not) be "appropriate", but the farther north they go, the more inappropriate they become. If one's goal is to minimize heat loss from a building, one should begin with an understanding of how heat leaves it. There are two main routes: conduction through surfaces and infiltration of cold air/exfiltration of heated air.

Apart from Wendell Beckwith's home on Whitewater Lake, of which I have only read and my own house in Big Trout Lake, I have yet to see one northern building which appeared to take note of either factor. The most obvious area is insulation but most northern buildings would not meet current southern codes. This is despite the higher energy costs and the fact that, for heating purposes, the climate in Lansdowne House is twice as severe as that of Toronto.

Obviously there is plenty of room for improvement in building design, attending to such factors as size, shape, insulation, vapour/infiltration barriers, windows, entrances, siting (windbreaks, etc.) below grade construction, etc. None of this is new technology; it is simply a matter of rearranging existing components and concepts to produce the most appropriate design. As an example of what is possible, the government of Saskatchewan has sponsored construction of demonstration home. It looks much like a typical family home but loses about 1/10 of the heat of the average home.

### 2.3.3. Wood Heat

Wood heat is certainly not new to the North. Its advantages, however, are still relevant or possibly more relevant than ever.

Depending upon species and dryness, a cord of wood has the same heat content as one hundred or more gallons of fuel oil. In the north, 100 gallons of fuel oil may cost as much as $2 - $300.00. From an economic standpoint it would seem that, at least in the remote communities, all buildings should have at least a component of wood heat. Combination wood/oil furnaces make the convenience of oil available to wood heaters.

Converting community buildings to wood heat (an example is the DIA school in Big Trout Lake which uses wood entirely) would keep money at home creating employment (instead of going to Arabs with various eye pigments) and stabilize prices. It would also provide the nucleus of a firewood cutting operation for which appropriate (technological) equipment could be purchased and the incentive to begin a forest management program, which many communities now need.

## 2.3.4. Solar Energy

### 2.3.4.1 Space Heating

Solar energy is not strictly a southern technology. The North has, in general, a high annual number of hours of sunlight. This is, in part, due to freedom from clouds and pollution, and, in part, due to long days in summer. While winter days are short, the heating season is long and it is in the area of space heating that the potential for solar energy is greatest.

Any surface can act as a solar heat collector since sunlight striking it will generate heat. Your body demonstrates this fact when you stand in a sunny window on a cold day. Solar energy systems simply improve the efficiency of collection.

Active systems are separate from the building (although they may be attached to its roof) and heat is transported to the building. Passive systems are the system - that is the solar system is the building itself. Sunlight is admitted through strategically placed (i.e. south-facing) windows and turns to heat while striking internal surfaces. Active systems may be expensive, requiring collectors and pipes, pumps, tanks and valves or ducts, fans and rock beds. Passive systems, on the other hand are more a matter of building design and orientation so, for new buildings, may have no cost at all. Despite their simplicity and low costs, passive systems are capable of supplying a large proportion of a building's heat requirement.

Unfortunately, the sun does not shine at all times we require heat - we have nights and cloudy days. The amount of useful heat collected can be increased by storing it when available and releasing it as required. Any material will store heat but the best are dense ("heavy") materials - water and rocks are commonly used. Once again, active systems have separate storage (often in the basement) while passive systems storages <u>are</u> the building or are in the building. Examples are water tanks or heavy masonry construction. This is one reason many of the building materials of the previous section were chosen. Not only can heavy materials store solar heat but they will help even out temperatures throughout the day, which is desirable in wood heated houses.

Anyone who has lived in a solid brick house during a summer heat has experienced the heat storage capability of masonry materials.

Solar systems need not be built in at construction. Although that is desirable, they can, in a number of ways, be retrofitted to existing buildings.

2.3.4.2. Solar Electricity Generation

There are several ways in which the sun may be used to generate electricity, but the most likely for the North is the solar cell. Solar cells were developed for space where other fuel sources are expensive (and we think we've got transportation problems!) but there is no night, cloudy days, pollution, or even atmosphere. Naturally, solar cells are not as efficient in terrestrial applications and the cost is high. However, a massive support program by the U.S. government is bringing the cost down and maintenance and operating costs are minimal.

2.3.5. Electricity Generation

2.3.5.1. Small Scale Hydro

After fire, the harnessing of falling water was probably man's first use of synthetic energy (i.e. other than manual or animal). Falling water is mechanical energy so it is not surprising that its first uses were mechanical - turning grindstones, operating looms, presses etc. Such uses are still legitimate but falling water's usefulness can be extended by conversion to electricity (hence the name "hydro").

Hydro can be made on any scale but large scale hydro, especially in a flat country such as Northern Ontario, can be very environmentally destructive. Since the purpose of large scale hydro projects in the North would also not be for satisfaction of local needs, such projects will not be considered here. Rather, we will consider smaller projects which could supply anything from individual homes to a whole small community, although the theory is essentially the same.

The amount of power available from a hydraulic turbine depends upon the head (the difference in water levels from intake to discharge) and the quantity of flow available. The head is relatively constant for a given installation but flow may vary by the seasons, (usually being low in winter and high in spring) or the year. While a dam is in no way necessary, it may be added to improve performance by increasing the head and/or regulating the flow according to energy demand.

A community of about 500 people could generate all its electrical requirements from an average size river with a drop of 10 feet. There are hundreds of such sites in the North. However, each installation's mechanical equipment must be tailored to the head and flow available and each installation's "civil works" (dam, penstocks, power house, etc.) are unique and site built. The cost of power transmission facilities are another important consideration. While hydro installations are available "off the shelf", it is unlikely, in light of the above, that it will ever be mass produced. It would appear that, unless free labour and used equipment is available, the cost of individual - house - scale installations is prohibitive at present. Community scale projects on the other hand, show great promise. Although capital cost is higher than for diesels, the maintenance cost is low, fuel is free, and reliability and longevity are high, leading to a low life - cycle cost.

### 2.3.5.2. Zero Head Hydro

Rather than using the energy of falling water, this method relies on the flow of water. The basis is this: if a current of air (wind) can turn a propellor, a current of water can do it 800 times as well. This is not just a theory, equipment is available and, I understand, being used in Scandinavia. For a community on or near a fast flowing river (Ogoki comes to mind) this source may have good potential.

### 2.3.5.3. Wind

Any serious study of wind power potential in Canada generally concludes that there isn't much potential except in windy, remote locations in the North.

Well, that's what we're talking about here! In fact, the potential in the south may be underestimated, as demonstrated by Consolidated Edison who are installing windmills in the mountains to generate electricity for Los Angeles.

Wind equipment is, or is becoming, available for a wide range of scales from individual home to whole community. While life - cycle costs are beginning to become competitive in the North, several restrictions should be considered in use of wind power. First, the amount of energy available varies with the cube of the wind speed (double the speed and you get 8 times the energy). This makes a windy regime desirable but also favours a gale-and-calm regime over a steady regime. Second, wind speeds can vary from site-to-site in an area according the topography, vegetation, bodies of water, etc. This makes site selection most important. Thirdly, the wind speed varies throughout the day, from day to day and season to season, not necessarily in tune with energy demand. This generally makes some sort of storage or back up desirable, although it may be better to have energy when the wind blows than not to have it at all.

Wind energy is also mechanical energy and its oldest uses are mechanical: pumping, turning, etc. These are still its best uses but the desire for electricity is leading to the major attention being paid to generation applications. Battery storage is, at present, so expensive that a diesel backup may be better, with the wind mill serving as a fuel saver. Another interesting possibility is pumped water storage with hydro electric generation.

### 2.3.5.4. Thermal Generation

Most electrical utilities, including Ontario Hydro, generate a large percentage of their power by burning fuels. The heat generated is converted to steam and hence, by turning a turbine and generator, to electricity. The fuels used are usually nuclear (ignored here) or fossil (coal, lignite viz Onakawana, oil or natural gas).

These fuels are not likely candidates for the North but anything which burns can be used. We certainly have plenty of things which burn:

a) Wood.

Plenty has been said about the use of wood as fuel. This could include logging wastes, sawmill wastes, less desirable species and "energy plantation" wood (fast growing species like poplar are promising).

b) Peat.

Peat is used for electrical generation in much of Europe. It can also be used for space heating but small buildings would likely be better suited to wood. Canada, however, has more muskeg than any country in the world and most of it is in the North. Under all of it, from it 100 (average 10) feet deep is that black muck called peat. Pound for pound, dry peat has the same heat content as coal but is, of course bulkier and harder to handle.

c) Other fuels.

One could also use any of the other fuels discussed in this report such as methane, alcohol, etc. Other possibilities include garbage, waste oil, etc.

d) Waste Heat.

The thermal process is very inefficient in terms of converting heat to electricity and a lot of heat is wasted. The possibility of using this waste in greenhouses has already been mentionedbut other possibilities suggest themselves when one considers industrial processes. However, district heat is very common in the south and throughout the world. Heat is piped - in the form of steam or hot water - in pipes which may be buried or in utilidors to buildings nearby. This system need not operate off waste heat, for fuel may be burned specifically to provide heat - as is the example at the University of Toronto. This might, in a close-knit community, allow the advantages of wood, peat, etc. heat without the disadvantages.

## 2.3.5.5. Wave and Tidal

These are two forms whose applicability is limited to those communities of the North located on salt water.

Wave energy systems attempt to harness the energy in water waves but there are no waves when the water is frozen. Equipment is, at present, experimental.

Tidal generation is essentially specialized hydro - electric equipment which attempts to burn the candle at both ends - when the tide comes in and when it goes out. Naturally, the greater the tide the greater the potential energy. In Northern Ontario application may be limited by topological features like wide tidal flats.

### 2.3.6. Methane

Methane is the principal ingredient of natural gas. It got there by decomposition of organic matter. Surprise - swamp gas is also mostly methane by the same process. About 5 years ago, service on an experimental STOL service was delayed because the Montreal airstrip was built on an old garbage dump. Decomposition of the garbage was generating methane which seeped through the pavement causing a safety hazard.

Since virtually any organic matter can be digested to produce methane, we should investigate this energy source made from wastes such as garbage, sewage, manures, agricultural wastes, etc. The most promising of these is sewage and manures and, in fact, methane production from these sources is not new technology. The Humber Sewage Treatment Plant in Toronto uses methane to operate its engines and small scale "bio-gas" generators in India and China number into the millions.

Nonetheless, there are serious problems to consider in the application of this technology in the North, not the least of which is climate, our old favourite. The methane production process is bacterial and highly temperature dependant. This means that, unless someone comes up with a clever scheme, heat input required may reduce the net energy output to zero in cold weather.

A second problem is gas output. A family's sewage will not provide its own total energy needs - possibly only cooking and/or lighting. It would seem, therefore, to be most promising when carried out on a community scale.

There are also questions of economics. For agricultural operations using manures (the most likely application with municipal sewage) it appears that a farmer can produce fuels at competitive cost only if he does not account for his own labour.

However, problems not withstanding, methane generation should be carefully considered in the North because methane is one of the few local sources of energy which can substitute for fossil fuels (propane, gasoline, diesel fuel) and electricity in cooking, lighting and running engines. An added bonus is the high quality fertilizers remaining after digestion of sewage, manures and animal wastes.

### 2.3.7. Alcohol

Alcohols are also of interest because of their ability to replace fossil fuels, mainly in transportation. There are two types: ethyl and methyl.

Ethyl alcohol, common name booze, is made by fermentation of sugars followed by distillation (purification) if required. Any plant material containing sugars can be fermented as has been proven by ingeneous homebrewers the world over. The simplicity of the technology is well known and it can be practiced on any scale from basement to Hiram Walker. The world's most ambitious program is being undertaken in Brazil where sugar cane plantations are being dedicated to ethanol production in an attempt to completely eleminate fossil fuels in transportation. Gasohol, a mixture of gasoline and alcohol requiring no or minimal engine modifications is now on sale in some American states.

The other common alcohol is methyl, alias methanol, wood alcohol, Aqua Velva, etc. It has been used as a racing car fuel for ages requiring only minimal modifications.

Presently, it is made, like everything else, from petroleum feedstocks but can also be made by a process of distillation (I think) from wood or similar plant materials. The technology exists and appears feasible for large - scale wood alcohol production in the North. I am not aware of small scale (e.g. backyard "still") technology for the production of methanol.

As noted, alcohol's most likely application is in replacing gasoline - it would make a low quality diesel fuel. As an added bonus, it tends to burn much more cleanly than gasoline.

### 2.3.8. Gasification

Fuels like wood and peat can be gasified by partially burning in an "airtight" container. This may be a simple process carried on in 45 gallon drums or a full scale industrial process such as was proposed for Onakawana. The gas produced can substitute, again, for fossil fuels and, in fact, it is possible to run an engine on the smoke from an airtight wood stove. However, the raw gas tends to be somewhat dirty, containing such undesirables as tars, alcohols and solids.

When coal and wood are gasified, the remainder is coke (but not, unfortunately, the real thing) and charcoal. I suppose the residue of peat might be "poke". These fuels are useful not only for barbequing, but also for blacksmithing and "foundering" (foundry work) to be discussed later.

### 2.3.9. Natural Refrigeration/Freezing

The world's oldest compliment of salesman's ability refers to selling refrigerators to eskimoes. Indeed it does seem silly to be using an expensive, high quality energy source, electricity, to produce cold in an area which has 10 months of winter and two months of poor sledding.

As noted in the solar section, dense materials like soils and rock store heat rather well and the ground temperature tends, at least below a few feet "active zone" at the surface, to approximate the annual average temperature.

This may vary, in Northern Ontario in the range of ±5 degrees celcius to -5 degrees celcius. Of course, where the temperature is below zero, we have permafrost.

Dig a hole in the ground, insulate as required and you've just invented the ice house. In permafrost, you have a year round freezer free of operating cost. I have a picture of one full of frozen fish in Siberia.

To my mind use of any means of refrigeration/freezing other than natural anywhere in the north is wasteful.

## 2.4. Manufacturing & Services

### 2.4.1 Woodworking

When one lives in the middle of one of the world's last unspoiled forests, it behooves one to investigate possibilities for producing one's needs by shaping wood. This is exactly what the Big Trout Lake Indian Band Council did and, as a result established a woodworking shop to produce furniture and cabinets for the local market.

Woodworking is a labour intensive activity requiring a minimum of equipment. Once one has the facilities, one finds a wide variety of products that can be made: housing materials like cabinets,doors, window frames, millwork and trim, furniture, boats, sleighs, coffins, toys etc. Products can easily be tailored to local conditions since the scale can be small and local material costs are not a large portion of total costs.

### 2.4.2. Mechanical Repair

No technology is appropriate in a given society if its hardware cannot be repaired locally. Repairs are generally available in the "southern northern" communities but it has been my observation that they are not in the remote communities.

Since there is no George to "let do it", individuals become rather proficient at making their own minor repairs but perfectly serviceable equipment is often retired long before its time for lack of repair facilities.

The establishment of repair facilities is basically a matter of training. In a small community, repair persons must be very versatile which means a variety of training is necessary. Otherwise, a large investment in tools, equipment, parts, etc. is not required and modest facilities will serve, at least to begin.

Areas which require repair facilities include small engine equipment (outboards, chain saws, snowmobiles, motorcycles, generators, etc.) cars and trucks, diesels (generators, vehicles), appliances and, possibly, electronics. Many of these areas are related but still, a great deal of versatility is required.

### 2.4.3. Fiberglass

While the fiberglass process does not use materials indigenous to the North, it does offer several advantages. It can be a very low capital, labour intensive process and is well suited to the production of complex shaped and/or bulky objects such as boats, tanks, plumbing fixtures, furniture, and replacements for sheet metal in vehicles.

The hand layup process is rather simple and requires a minimum of tools, facilities and training - I know because I have personally conducted fiberglass operations in remote communities. A mold (often made of fiberglass) or other supporting framework of wood, wire mesh or whatever is appropriate is prepared and covered with a suitable fibergalss fabric. Into this is worked, by brush or roller, a resin which hardens by chemical reaction. Production rates may be increased by spraying the resin or better, a mixture of chopped fibre and resin but the latter entails a sacrifice in strength, weight, material cost or all the above.

The resulting product is, if well designed, relatively light weight for its strength and resistant to virtually all chemical processes including corrosion. It is not, however, very fire resistant and health and safety problems must be considered in the manufacturing process. As well, imported materials are used, material coats are a significant portion of total costs and the resin is manufactured from petroleum feedstocks. Nonetheless, the advantages of fiberglass make it worthy of serious consideration for the North.

### 2.4.4. Metal Working

#### 2.4.4.1. Introduction

While other materials are important in technology, surely metals are the sine qua non of modern technology. The first metal man used was copper, because it occurs naturally in almost pure form and can be easily melted and shaped. It is, however, rather soft and can only be hardened by "cold working", that is hammering or other mechanical process at room temperature. The next step was bronze, an alloy of copper, tin and zinc. While it is harder and will hold a better edge on cutting tools, it is brittle and cannot be cold worked so must be cast (poured molten into a mold) to shape. Brass is a more recent alloy of copper and tin, which is not as hard as bronze but can be cold worked. Today,copper and its'alloys are rather expensive base metals and are generally used only where their superior properties of corrosion resistance and/or thermal and electrical conductivity (or, for bronze, wear resistance) are required.

It was not until the "invention" of iron, however, that modern technology could come of age. Pure iron is a soft, ductile (cold-workable) but relatively strong metal. It is seldom used in the pure state, however, as alloying with very small amounts of carbon (less than 1%) change its name to steel and impart important qualities of strength and, most important, an ability to be hardened by heat treatment. This allows shaping in the soft, ductile state (most steel is also used in this state) along with final hardening. This quality, along with steel's low cost, wide availability in a variety of shapes, easy workability and high strength make it a natural choice for most general structural requirements.

When the carbon content of steel exceeds about 2%, the properties again change and the name goes back to iron. Since it becomes brittle, it can be formed only by casting (and, of course, machining) so is generally called "cast iron". Castings are well suited to parts with complex shapes and cast iron is usually used for parts which do not need great strength but can benefit from cast iron's good wear properties: engine blocks, housings, brake drums, manifolds (devices which join several pipes into one) etc.

Aluminum is a modern material. It is not as easily worked nor as versatile as iron; it's moderate strength together with light weight make it desirable for high performance use such as pistons,aircraft parts,lightweight housings, etc. It can be cast, mechanically shaped, and some alloys can be heat treated. It also has desirable properties of thermal and electrical conductivity somewhere between iron and copper.

There are many other metals such as magnesium, titanium and even more exotic, but they fall beyond the scope of what we are examining here. In fact, only a narrow range of the possibilities looks promising for the north: casting,mainly of iron and, possibly, aluminum and bronze, and steelworking. The Chinese proved that steelmaking is not practical on a small scale and aluminum and brass have limited usefulness.

### 2.4.4.2. Foundries

Iron is made from ores, limestone, and coal. Birmingham Alaba a is the only place in the world where large deposits of all three occur in the same place. The North has quite a bit of iron ore and large and small deposits (cobbles, boulders, bedrock) of limestone. Charcoal has already been discussed, so small scale iron making may be possible in the North. There is, however, another, easier source of iron: scrap castings and steel. They are abundant in the North in the form of dead vehicles (which can also supply many parts), 45 gallon drums, old stoves and appliances, etc.

Aluminum is very difficult to make but some scrap is also available in crashed aircraft and miscellaneous housings, etc. in dead boats, vehicles and machines.

The casting process is relatively simple. A cupola, used for melting the material is made principally of heat resistant clay which may (or may not) be available locally. When the metal is molten, a hole is punched in the cupola and it is drained out the bottom into molds, usually made of sand (yes folks, hard to believe, but just ordinary sand is what General Motors uses to cast its engine blocks). After cooling, the castings are cleaned and machined as necessary.

High performance castings requiring a lot of machining may not be practical for manufacture in the North but a number of products could be manufactured from simple and relatively rough castings. Parts for high performance wood stoves, or whole stoves could form a mainstay of the foundry. Aluminum and iron cookware are another good possibility and someone with imagination could cast spare parts and other odd parts. Bronze could be used mainly for bearings, pump parts, etc.

2.4.4.3. Metal Working

Metal working generally involves shaping relatively thin sections (sheets, bars, angles, etc.) and joining them.

Shaping can be done by several processes, the simplest of which is basically bending. Thin sections can be formed cold but thick sections may require heat. Cutting may be done by shearing, sawing, or with steel, by oxy-acetylene (or propane) torch. Joining may be mechanical (bolts or rivets) or by heat (welding, brazing, soldering). Where high precision is required, machines such as drills, mills and lathes must be used to remove metal.

The equipment required for metal working is heavier than woodworking and more expensive but a skilled worker can do amazingly good work with simple equipment.

For processes requiring heat, a "new" approach may be required. Electric welding machines are available operating on gasoline or electricity but the cost of transportation makes the use of gases such as oxygen, propane and acetylene very high. The charcoal fired backsmithy may be a viable proposition in the north.

Steel would be the most likely material and products could include wood stoves,sleigh runners and hitches, duct work and miscellaneous parts and repair work. Aluminum or brass might be used occasionally for special work.

Scrap may supply some of the material: the North's second most abundant resource is 45 gallon drums and dead vehicles and stoves abound. As well, it will be necessary to import some raw material; cost is not usually a large portion of metalworking costs.

## 2.4.5. Craft Work

### 2.4.5.1. Introduction

Appropriate technology attempts, where possible, to build on indigenous skills. At least in the Indian community, a wide range of traditional skills still exist, but, like most hand done craft work, the profitability of these enterprises is often questionable. One approach is the use technology to improve productivity without loosing individuality. Another is to use the indigenous industries to lead into similar more promising ones.

### 2.4.5.2. Fabrics and Furs

One very likely area is furs and fabrics, building on indigenous hide work. Several possibilities present themselves:

- furs - warm, serviceable coats, hats, etc. made from locally trapped or ranched furs.
- duffle - "traditional" Kulatuk - type coats
- down clothing, sleeping bags, quilts, etc.
- fabrics woven from wools of sheep, goats (angora) highland cattle, etc.

Generally speaking, the equipment required is simple.

### 2.4.5.3. Ceramics

There is, at present, no indigenous ceramic industry as the traditional skills would appear to have been lost. However, the raw materials, clay, and glazes, occur in great abundance. In the south, hand made pottery is not able to match the price of mass produced products but nonetheless, able to compete on the open market by offering individual design. The situation in the North may be more favourable and may even allow the establishment of an export industry.

### 2.4.6. Food Processing

### 2.4.6.1. Bakery

Like making pottery, baking is one of man's oldest, and therefore simplest, skills. I will not consider the questions of whether suitable grains could or should be grown in the north. Certainly flour could be milled and bread, pastries, etc. baked, as they are on a single-loaf basis now.

The problem is energy. Modern bakery equipment is operated on oil, gas and electricity which may, at present at least, be a problem. Once again, however, the past can come to our rescue with the brick oven. It is a massive oven made of brick or stone. There is no separate firing system; rather, the fire of wood or other suitable fuel is built directly in the oven itself. It is allowed to burn for a matter of hours until the oven is up to baking temperature and the fire raked out of the oven and the bread or other product placed inside. Baking is done by the heat stored in the oven's mass.

If the situation warrants it, the oven may be fired continuously in a separate chamber.

It is ironic that with all our modern technological "improvements", health food fans prefer stone ground, whole wheat, brick oven bread.

### 2.4.6.2. Pop Factory

Those same health food fans hate pop. It certainly does lead to many problems in the North beyond the economic drain. These include dental and general health and litter.

Education and increasing the availability of alternatives offer some hope for reducing the harmful effects of pop in the future but it appears, at least for the time being, that Northerners will continue to consume large quantities of pop. If they are to suffer the ill effects, Northerners (rather than others) might just as well also receive the benefits, largely economic, of local pop bottling.

When Northerners import pop, they import water, sugar, flavour, "fizz" and containers. Taking water north is certainly a case of coals to Newcastle. Use of recyclable containers may or may not reduce the litter problem, but would mean that only flavours, sugar and "fizz" need be imported. Re-formulation of beverages might make their health aspects a little less destructive: this could include natural juices (grown in the North?) Certainly the economic incentive is strong: my own estimate of pop consumption is one community of 700 people was $125,000 annually.

That small scale pop bottling is economically viable, even in the south, has been adequately proven by franchised and independant bottlers. Equipment is not highly complex or expensive.

### 2.4.6.2. Brewing and Distilling

The technology of ethyl alcohol manufacture has been discussed earlier and its feasibility has been adequately demonstrated throughout the North and the world. Certainly, large quantities of alcohol are consumed in the North, both legally and illegally. Whether this is the cause of problems or the result of other problems is a question beyond the scope of this project. Nonetheless, like pop, it appears that if Northerners are to suffer the ill effects of alcohol consumption, they might as well at least not add add economic injury to social injury. As well as producing for local consumption, where legal, Northerners might consider the export market where there is a strong demand not only for the standard liquors but also specialty beverages like Tequila and Screech.

## 2.4.7. Minerals

When North Americans think of minerals they think in terms of millions of tons per day, but the whole world does not join them. In many places, Europe for example, small mines are the norm. The purpose of this report is not to say that there is not a place for such large scale operations in the North but rather that they should form part of a balanced approach to economic development, especially where non-renewable resources are concerned. I have stated an intention to consider alternatives to present methods.

The Northwest Ontario Prospectors Association is preparing a report concurrent to this on the possibilities for small scale mining in the North. I Would not pretend to upstage a much better qualified group than I but they tell me that the Barriers to small mines are largely institutional. In fact, there are many small deposits which could provide employment and raw materials for export or local needs. For export, the most promising ores are the precious metals as transportation problems are reduced. For local use iron ores or native copper might find some application.

Technology is simple as such deposits could be worked from the surface. In pre-columbian times, Indians mined copper near Thunder Bay, with nothing more than fire and water, to depths of 30 feet. Today, we might increase productivity with pneumatic drills and explosives. Processing equipment would consist of crushers, ball mills and other simple equipment depending upon the ore. For gold, it might be as simple as crushing and panning.

Such activities also promise to be easy on the physical environment.

Minerals are found in great abundance in the North and can be used in many other ways. Rock shops are the fastest growing business in North America and several magazines are devoted to gems and minerals. While the North does not, to my knowledge, have precious stones, it could be supplying rock and fossil samples and lapidary supplies on an economic basis to the rock shops and scientific supply houses. Distinctive local jewellry,sculptures and souvenirs could also be made from locally occurring minerals such as carnelian, amethyst, soapstone, agates and even imported materials.

### 2.4.8. Commercial Fishing

Commercial fishing is well established in the North but its economic viability is questionable. To many engaged in the fishery, profit is not an important consideration but pressure from government and others may force improvements in profitability.

Technology might make some minor improvements in efficiency of ice harvesting and ice house design/construction but the real promise appears to be in fish processing. Presently, fish is processed for sale whole or in fillets. This necessitates icing fish and daily air charter flights to carry fish to a central packing plant. It appears to me that this narrow minded approach requiring expensive air freight is at the root of the problem.

The first possibility, then,would simply be the same type of processing but carried out on a smaller scale in more locations - possibly on the lake where the fish products could be held until the best transportation is available. The next step could include alternative (or additional) processing as, for example, in the manufacture of fertilizer, cat food, animal feed, glue, etc. These processes would also consume offal and "trash" fish which are presently "wasted". These by-products could also be used as feed for farmed fur-bearing animals such as foxes or farm animals like pigs(?).

## 2.5. Transportation

### 2.5.1. Introduction

Few would disagree that transportation is a major problem in the North, especially in the remote communities. An example will illustrate.

I worked on a project in Big Trout Lake which required the importation of equipment, building materials and some consumables during the start - up phase. Virtually everything that had to come in came by air for 30¢ per lb. as general freight, although charter rates might be less. However, although as a rule of thumb, transportation doubled costs, cost was not the major problem. Delays were interminable. Three to six weeks was a common waiting period for materials in stock in Thunder Bay. If one wished to pay 55¢ per pound, minimum $20.00, the delay could be reduced to about 3 days for small items or envelopes. When goods did arrive, they were often damaged.

The root of the problem is not technology but monopoly. Virtually all of the carriers operating in the North, be they rail, truck or air, operate as monopolies. They do not need to offer good service and most appear to make no attempt to do so. It is even very difficult to get them to respond to complaints.

However, while the problems are not technological, the availability of technology will determine whether or not a diversified transportation system can be put into place. A good example is the winter tractor train. Where possible, we used that service in Big Trout and we found it cut our transportation cost in half.

The emphasis here will be on freight carriage. Passenger service is highly speed dependant and it is unlikely that the aircraft will ever be supplanted in this area. While the primary objective of the alternative schemes to be considered here is cost reduction, cost is not the only criterion of appropriateness for a transportation mode vis a vis economic development. Also important are local control, employment, retention of revenues and profits within the community and ability to handle goods (mainly bulky and/or heavy) not transportable by other modes.

## 2.5.2. Land Transportation

### 2.5.2.1. Narrow Gauge Rail

The gauge of the rails is not, in itself an important issue. The point is that railroads need not be copies of the CNR. Examples of alternative rail systems abound throughout the world from the White Pass & Yukon, through the San Francisco street cars to any number of mine installations, carnival rides (roller coasters) and marine railways.

Compared to standard rail systems and all weather roads, alternative rail systems offer possibilities of low construction and operating costs.

Steel rails, for example, may not be indigenous to the North but there certainly are plenty of them in abandoned mines in parts of the area. And why are steel rails essential? Railroads were invented on iron rails. Could we not use wooden rails, possibly with steel plating, for light or infrequent service?

Ties certainly are indigenous and could be cut right on site. If the road bed, track and equipment are considered together, the bed could be very inexpensive - essentially laid over existing ground, whatever it may be (other than, of course, water). Muskeg is the most difficult to deal with but a simple solution would be to simply drop trees on its surface.

Rolling stock could come from a variety of sources: mines, standard railroads (e.g. "jiggers", etc.), or streetcars, amusement parks, converted automotive equipment, etc. or could be built to order, likely locally. Power sources could be gasoline, diesel, steam or electric. For specially built equipment, much of the mechanical equipment could be salvaged locally and bodies built locally of wood. Passengers could also be carried in wood heated cars.

#### 2.5.2.2. All Terrain Vehicles

Actually these light weight, tracked vehicles should be called "most terrain vehicles". They can negotiate hard ground and soft surfaces such as muskeg and snow and most can ford some water with depths ranging up to 4 feet.

As well as tractors, trailers are available which would allow year round tractor train service, at higher capital cost than winter trains. One disadvantage is that repeated use over muskeg does cause some envrionmental damage.

### 2.5.3. Water Transportation

#### 2.5.3.1. Jet Boats

The fur trade was built on water transportation and it is still often the least expensive mode available. Unfortunately, Northern Ontario's rivers have many nagivational obstructions like shallows, rapids and falls. The Bays (James'& Hudson's) are subject to storms and wide tidal flats. Several modern (and old) vehicles and methods are available, however, to overcome these problems. One of these is the jet boat.

The steam powered sternwheeler was used throught the world on shallow river systems, but, especially when steam driven, it suffered poor efficiency. The water jet drive can do the same job now, with efficiency comparable to propellors.

Using the same principle as the jet aircraft, the water jet sucks water in a hole in the bottom of the boat and shoots it out the stern for propulsion. Steering and reversing are accomplished by deflecting the jet. Most of the unit is inside or behind the boat with no props, rudders or other devices projecting below the bottom of the boat. Given adequate power, water must be very rough indeed to be unnavigable to the jet boat.

The water jet, an off-the-shelf item, is best suited to highspeed planing hulls. It is possible to plane a jet boat over water so shallow that reducing the speed would cause it to hit bottom.

Jet boats are used extensively, although largely for recreation, on the river systems of western Canada.

2.5.3.2. Hydrofoils

The hydrofoil is a child of modern technology which must be seen to be believed. Invented (?) by Alexander Graham Bell on Nova Scotia's Bras d'Or lakes, it appears at rest to be a relatively normal boat. Once past the displacement mode speed, however, it rises completely out of the water and "flies" on underwater wings, or foils.

You might well ask "why?". There are several reasons. If you are a speed freak you will love the hydrofoil; the Canadian Armed Forces now defunct hydrofoil warship Bras d'Or set a speed record at about 80 m.p.h. The reduced (or eliminated) hull friction also improves fuel efficiency. In the foilborne mode, the draught can be quite shallow.

The proof, of course, is in the pudding. While Trudeau has taken the Navies' toy away, hydrofoils are gaining world-wide acceptance, being manufactured chiefly in the USSR, USA and Italy. The most interesting of the many applications is the Soviet Union where the speed of a fleet of shallow draft hydrofoils helps move maximum quantities of freight on rivers during the short Siberian summer.

### 2.5.3.3. Sail

Very little need be said about sail as a source of energy except that it could have limited usefulness as a fuel saver, especially on the bays or large lakes.

### 2.5.3.4. Navigational Obstructions

Three approaches suggest themselves.

a) Remove the Obstruction:

This may be simple in some cases, difficult in others but the idea is to provide a clear channel of adequate depth for a vessel to pass. If the current is too strong for the power available, a winch can draw the vessel up, or let it down, the channel as is done, for example, on some Chinese sampans.

b) Create an Artificial Channel:

When logs were floated down rivers, they often passed obstructions by running down wooden flumes. A similar system might let boats travel up and down stream as above.

The next step is a lock but locks are likely to be practical only near roads or in conjunction with a hydro-electric installation.

c) Bypass the Obstruction:

One approach here is the marine railway, discussed in a previous section. Another interesting possibility comes from logging's past. It is called the alligator and it is a tug for hauling log booms. The interesting part was the hull which was a catamaran with flat bottoms. The name alligator comes from its amphibeous nature because it winched itself across portages, apparently sliding on a wooden "boardwalk".

## 2.5.4. Air Transportation

### 2.5.4.1. Rigid Airships

T.V. watchers will recognize the Goodyear Blimp as an advertising device and remember the Hindenburg, R101 etc. as monumental disasters. While there are serious problems with the rigid airship, it is gaining considerable attention worldwide as freight vehicle, especially in remote areas.

The airplane uses fuel to hold it up in the air while the airship uses a bag of gas. This makes the airplane the most energy - intensive mode of transportation and one of the rigid airship's promises is improving this situation.

## 2.5.5. Multiphibious Modes

### 2.5.5.1 Hovercraft

The hovercraft is another child of modern technology. A rather simple hull is supported on a cushion of air supplied by a fan. In order to increase "ground clearance" and, thus, ability to traverse rough ground, a flexible skirt is fitted to the bottom of the hull. Propulsion may be provided by air propellors or the hovertrailer can be towed by another vehicle.

So what's the big deal? Well, first, the craft does not actually touch the ground, but floats over it. This means it can float over any type of ground: hard ground, ice, snow, muskeg, water. The true all terrain vehicle (except steep hills, relief greater than the clearance height, and dense bush). Certainly fuel is used to hold it off the ground but, in the case of water, there is a net fuel saving advantage as the friction is reduced. The hovercraft is also a nice method of moving heavy equipment, especially where good roads are not available. Finally, the hovercraft was accidentally discovered to be an excellent icebreaker. The air cushion pushes itself under the ice and, without water to support it, the ice breaks under its own weight.

The hovercraft is not a pie-in-the-sky theory; it is being used in the Canadian North (but not, I believe, Ontario's North) and all over the world.

### 2.5.5.2. Air Cushion Landing System

Why don't we put a hovercraft on the bottom of an aircraft to have a land-anywhere "amphib"? NASA have done it and it works. It can even land facing into the wind when the wind is not blowing directly down the runway.

However, it does have certain disadvantages such as increasing weight and energy consumption. It it therefore not likely to find wide use but only in specialized applications such as the air ambulance.

## 3. Conclusion

We have looked at the philosophy of the appropriate application of technology and at a bewildering array of likely technologies for Northern application. Of course, there are many more technological possibilities but only "proven" ones have been considered.

What is clear is that there is a wide range of alternatives available. Where standard methods are not working well we need not accept them; with even a little imagination we can find all sorts of alternatives. There is also a wide range of resources available in the North which, given the right technology, could be used to assist Northerners in reaching demonstrably attainable economic self-sufficiency.

What is also clear is the unimaginative nature of the idea that Northern communities have no reason to exist. In fact, given the North's wealth of resources, we might more pertinently ask, "What reason has Toronto to exist?"

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VOLUME II

The Project

## WORK PROGRAM CHRONOLOGY

### 1.0 IN THE BEGINNING

I received word that my project had been approved early in September but, apart from a few letters and telephone calls, I was not able to begin in earnest until early November.

I had not had a response to my letter to Mr. John Perrott, President of the Armstrong Development Corporation so I wrote again in September. He called me back and indicated that he did not understand what my project was about or even what technology was. I therefore decided that the best thing was to visit Armstrong on my way from Big Trout Lake to Timmins.

In Armstrong, I spoke with a number of people including Mr. Perrott and Hector King, President, Armstrong Local, Ontario Metis and Non-Status Indians Association, Ray Laird, owner of the King George Hotel, Jack Lundstrom, Partner - D & L Estates (ex RCAF base converted to apartments, motel, restaurant, etc.), Gordon Smith, owner of the Sportsman's Lodge, Doug Sinoway, Chief of Whitesand Indian Band and Ron King, Band Manager of the Gull Bay Band. I repeatedly heard the same messages:

1) "I don't understand what you're talking about" (that one was a shocker because I was trying to avoid jargon and make things

... 54

as simple as possible).

2) Lack of awareness, expertise and resources are not development constraints in Armstrong. Rather, everyone expressed difficulty in getting people to work together.

3) Little interest was expressed in my project except by Hector King who noted that he had found audio-visual presentations very educational and wished to participate.

Accordingly, I decided not to impose myself on the good citizens of Armstrong.

I had "picked on" Armstrong because of its unorganized community status, although that meant I had to speak to a number of people whom I arbitrarily defined as community leaders. Sioux Lookout, on the other hand, has a regular municipal structure through whom I communicated.

Despite several visits, I was unable to meet with the mayor, Mr. John Parry, who was, at any rate, running for election during most of the project period. I did, however, meet on two occasions with the Town Clerk, Mr. Phil Salem. He initially expressed an interest in participating in the project but, as the details came cleared, his interest appeared to wane. He also felt that expertise and awareness were not problems and that there was a good deal of difficulty in arousing public interest

... 55

for matters such as this project. So, I also removed Sioux Lookout from the list.

I was left with the remote Indian communities to concentrate on. This was a blessing, in a way, as it simplified matters somewhat.

... 56

## 2.0 THE AUDIO VISUAL PRESENTATION

The first step in the preparation of the presentation was to outline the content material. I then set off about the countryside on a quest for photographs and advice on matters of form and content. I visited a number of people and institutions in Toronto and Ottawa including:

i) The Ontario Science Center
ii) The International Council For Adult Education
iii) The Public Archives Canada
iv) The Canadian Hunger Foundation

As I discovered what photographs were available and discussed the details with various people, the following guidelines began to emerge:

1) The basic message would be "Given the appropriate technology, there are all sorts of possibilities for the North". The means of conveying the message would be examples of past or present projects, taken from the North, where possible. The nature of the message requires as large a number of examples as possible. Concern would be with the message rather than details of technology.

2) The medium would be slides with a pre-recorded tape and automatic

... 57

slide changing. Videotape was considered, as it was more versatile, but it was rejected for the following reasons:

a) The cost was beyond the budget of the project.

b) There are several sized in common use.

c) I did not want to be dependant on other people's equipment.

d) Dubbing in various languages may present problems.

Film was rejected on cost grounds.

This process pointed back to the orginial concept - slides. Konwledgeable people advised me that 80 slides, the number in a Kodak Carousel, was about the maximum one could easily absorb in one sitting.

3) A desirable rate was about 6 slides per minute, dictating a narrative time of about 13 minutes. A pre-recorded tape was chosen because of this time requirement, for reasons of translation and because it would seem more polished. I felt nervous about changing slides manually with a language I did not understand. As well, "beeps" or other slide change signals tend to interrrupt the flow of the narrative. Therefore, although it required the rental of a tape recorder - slide synchronizer, automatic slide changing was chosen. Further "fancy" devices as dissolves with mulitple projectors were not felt justified.

... 58

From this point on two processes were carried on simultaneously. The first was obtaining the necessary photographs including preparing and photographing graphics. This was a relatively straightforward expediting process. It was also one which was not completed on time. Apparently due to the mails, three photographs did not arrive in time for the community visits. The second process was that of organizing the photographs and tying them together with a script. I received help from a large number of people on this part of the project and was especially fortunate to obtain the services of Mr. Allan Vigoda.

Allan is a freelance AV consultant who works regularly with the International Council for Adult Education, the group which co-ordinated the Big Trout Lake sewage study. He was therefore very sympathetic to the subject materials as well as the form of presentation. Altogether, the script went through at least four typed drafts before being finalized.

The final step was translation and recording. The Ojibway version was done by WaWaTa in Sioux Lookout. As I was working in Timmins, I can only comment on the final product, which was somewhat of a disappointment. Quality was poor and the language was, apparently, not as concise as it might be. This meant that the elapsed time was close to 30 minutes compared to less than 20 minutes for the

... 59

English. There was also a considerable delay in receiving the tape. The Cree version was done by the Ojibway-Cree Cultural Centre in Timmins, so I was able to work with Greg Spence and Helen Rodrique there. They had never attempted anything like this before and had difficulty with translation of concepts (more than terms) and recording. The process was much more time consuming than we expected and turned into a last minute rush. This meant a poor quality recording of some 25 minutes duration. It was, however, readily understood in Fort Severn. The problem of translation was a surprise to me as I have encountered a considerable amount of it with no apparent problem, even in discussion of technical matters. Several cures appear to be advisable. First, at least in AV matters, the translation should be "designed into" the script rather than "added on" to it at the end. The "designer" should also work with the translator at the time of translation and recording. Finally, adequate time, one man week or more, should be allowed for translation and recording for each language.

... 60

## 3.0 THE REPORT

Simultaneously, this written report was being prepared. It is a two (2) part document covering:

a) Description of the project (this part);
b) Catalog of possible technologies and discussion of philosophy of A.T.

## 4.0 LIAISON WITH OTHER GROUPS

I felt that it was desirable to maintain contact with other groups working on similar RCNE projects, not only for my own benefit, but also to promote a two way flow of information. I therefore contacted, at various times, the Northwest Ontario Prospectors Association (small mining), NORDINORD (peat), and the Timmins Agriculture Group and attempted to maintain contact with the latter two groups.

## 5.0 COMMUNITY VISITS

### 5.1 Introduction

Because of unforseen delays in obtaining photographs and translations, the community visits were put off until the very last possible time, the last 3 weeks of February. Even that timing was contingent on a

... 61

promise to deliver the Ojibway translation to the North when required. In fact, it was not delivered until a week later than required, so almost a full week was lost in the community visit period. This meant that the remaining time was rushed and two communities (Angling and Kingfisher Lakes) were missed entirely.

The typical government travelling approach is the "jet in-and-out" method with a quick meeting in between. I did not feel that this approach was either desirable or feasible for this project for the following reasons:

1) I was introducing new ideas and asking people to think about them and react with intelligent discussion. This requires that they have adequate time without other pressing matters on their minds.
2) The quick in-and-out method does not allow the visitor and the community a chance to get to know each other and thus build up a trust relationship.
3) Bands are under a great deal of pressure to solve a great number of pressing problems. They often are hard pressed to find time for a visitor whose business is not urgent.
4) The realities of northern travel together with the necessity, due to budget restriction, to use the least expensive means

... 62

available, meant that very little certainty could be attached to a travel schedule.

I therefore planned to spend about 2 - 3 days in each community. In fact, I covered 5 communities in 20 days spending between 4 hours and a week in each. It seems that 4 days might have been a better estimate but external delays slowed things down.

My reception was generally warm, it seemed that people felt I had something to offer and I was generally pleased with the response. Intelligent discussion usually followed the presentations and a genuine interest was expressed especially in the areas of housing, electrification and agriculture and the desirability of further information.

5.2 Community Visit Log

FORT SEVERN

February 11, 1980, 1:30 p.m.

- Spoke briefly with Chief, agreed to show presentation at special evening meeting.
- Evening, presented show to fair crowd (50 - 100? all ages). No discussion.

February 12, 1980.

... 63

- Showed presentation to senior school class (grade 5 - 8). Teacher, Mr. Bev Blythe, favourably impressed.

February 14, 1980.

- Showed presentation again at general Band meeting. No discussion.

February 15, 1980.

- Met in AM with Band leadership.

Present: Elijah Stoney - Chief
Ed Koostachin - Kayahna Council, Field Worker
Archie Stoney
Ken Thomas
Project Mamoatsokewin

Discussion:

1. Problems in E.D.
   - Funding always the first problem with no local financial resources. Government funding presently not adequate.
   - Community leaders knowledgable and motivated but difficult motivating general populace although need to be involved.
   - Welfare economy and mentality.
   - Lack of expertise. Need place to go for expertise and guidance in setting up projects.

2.0 Possible Projects Interesting Band.
   - Gardening - possible site 20 miles upstream - soil and climate

... 64

better.

- Electricity generation from wind, garbage, tide or current of river.
- Goose down factory
- Water/sewage

3. Recommendations for Futrue
   - Keep up with this type of work to motivate people.
   - Document success stories (eg. Gull Bay, Danny Slipperjack)

LONG DOG LAKE

February 21, 1980, 3:30 p.m.

Evening:

- Made presentation at small meeting of people of all ages
- Difficulty in understanding audio because of poor quality, noise of generator and possibly, dialect.
- Met with Henry and Simon Frogg, receptive to concepts presented which are consistent with their current thinking. They liked the slide show medium. Felt pictures were largely self-explanatory, even if audio poor. They felt the Commission should be investigating this type of alternatives and providing information <u>in any form</u>. Possible forms include:

a) written

b) photo collections

c) A-V

d) - conferences, workshops, etc (no larger scope than tribal council and tailored to individual needs).

- would use "1 stop shopping" source of expertise.
- projects of interest to Band: 1) Solar lumber kiln (in progress)
  2) Gardening (standard & animal powered)
  3) Poultry raising
  4) Alternative electrification

KASSIBONIKA

Arrived February 23, 1980.

February 25, 1980

- showed presentation to teachers comments favourable but no "bites".

February 26, 1980.

- met with Chief, Council and Band staff members (7 total).
- some difficulty with tape and dialect but understood.
- appreciated visuals and tape in Ojibway.
- already thinking in terms of appropriate technology so receptive to ideas.

... 67

- were interested in many of the possibilities presented especially those related to housing and electrification.
- however, everything presented quickly, so difficult to respond to and absorb.
- would like to see further productions giving detail on particular topics.
- problems in bringing projects to fruition:
    1) funding
    2) motivation (due to welfare economy and lack of self-confidence) - success stories would help, also to somehow chronicle history of Indian society to show, particularly young people, how society got to be as it is.
    3) expressed concern at southern bias of Commission
        - noted this project seemed to be reversing south-north flow of information.

WUNNUMIN LAKE

February 27, 1980.

- Arrived 3 p.m., brief meeting with Chief and about 6 councillors and Band staff.
- liked A-V format - felt photos and tape in their language helpful for understanding.

... 68

- would appreciate further A-V productions for information.
- most interested in electrification, especially wind and thermal, and agriculture (horticulture and animals).

BIG TROUT LAKE

I spent several days in Big Trout Lake on 3 occasions as it is the transportation center for the area. However, despite making prior arrangements, I was unable to meet with the Chief and/or Council. The Band is so busy that the Chief, key Councillors, and important Band staff were all "out" travelling during part or all of my visit. A group meeting was not therefore possible. I did, however, meet with several individuals and small groups to show the A-V presentation and discuss the concepts. This process was assisted by the fact that I had lived in Big Trout Lake and knew the people and the Band's orientation. It is probably the Band in Northern Ontario which is most attuned to the concept of A.T. and is presently implementing several A.T. projects such as water supply/sewage disposal, Band gardening, etc. They are most interested in alternative electrification and housing and are presently experimenting (with NRC) with wind and have an operational log housing program.

... 69

THUNDER BAY AND HEARST

After leaving Big Trout Lake on February 29, I stopped on the way in Thunder Bay and presented the A-V presentation to the Commission. Fortunately, most of the senior staff was on hand at the time.

I also stopped, at NORACT/NORDINORD's request, in Hearst to present the A-V show there.

## 6.0 CONCLUSION

In general, the objectives of the project (see Appendix II) were met. While it is difficult to measure such things as public awareness before and after, I think that the nature of the questions and discussions indicated that new ideas had been absorbed and that the approach was acceptable and desirable.

## 7.0 RECOMMENDATIONS

It is recommended that the Commission undertake a comprehensive program of research and public information in the area of alternatives. This should begin by making generally available the audio-visual program developed in this project. However, certain refinements are required before the presentation is ready to stand on its own without an accompanying speaker as this was not the object of the project;

... 70

1. Several of the photographs were included on a "best available at the time" basis. They should be replaced where better are available. Some of the graphics also require correction or supplementation.

2. The translated tapes should be redone to "tighten up" language and improve sound quality. They presently move much too slowly to prevent interest lagging. If this is not possible, more slides must be added. It would also be desirable to have a professional announcer record the English version.

3. Certain questions of format must be faced such as:

    a) Use of automatic versus manual slide changing (presently all tapes are set up for automatic).

    b) Use of music (presently only in English version) and obtaining rights to use it.

    c) Dialect, skill and dependability of translator.

While written materials may not be the preferred means of communicating, this report does give more detailed information than the audio-visual presentation and I recommend that, at least, Volume I be made available to the public.

... 71

Sincere interest in obtaining more information was expressed by virtually all groups exposed to the audio-visual presentation. Since its purpose was to introduce an idea (by overview) it could not give much information. I therefore strongly recommend that a program of public information on alternatives, preferably by audio-visual media, be instituted by the Commission. I recommend a series of slide shows to follow up on the present project. Topics of interest to the public and the Commission could include:

a) Water supply/sewage disposal.
b) Northern agriculture.
c) Housing - Local building materials
- Local renewable fuels
- More appropriate design and housing concepts.
d) Electrification (alternatives to diesel).
e) Northern success stories.

The last item, northern success stories, is a particularly important one, especially for Indian people. A common problem faced by all Bands I met with (after funding) was motivation. This is at least in part due to historical factors which have left Indian people, especially young ones, feeling that even if anything is possible, they certainly could not accomplish it themselves. A collection of northern success stories in community and economic development could help combat this problem.

APPENDIX I

THE AUDIO VISUAL PRESENTATION
(including script and slides)

# A.T. SLIDE SHOW - SCRIPT

* NOTE: Asterisk denotes slide change.

| SLIDE NO. | DESCRIPTION | SCRIPT |
|---|---|---|
| 1. | Lab (music begin and fade out) | Technology is the application of science skills and knowledge to the solution of human problems. * |
| 2. | Snow machine and House | Technology is things like motors and vehicles, airplanes, houses, TV, telephones and electricity. |
| 3. | Snowshoes | The traditional technology of the north includes * snowshoes, * |
| 4. | Canoe(Art Smith) | canoes and * |
| 5. | Log House (Arthur Beardy's) | log houses. These were sophisticated designs ideally suited to their times and places and are still widely used. However, they often look primitive in the face of such modern achievements as * |
| 6. | Aldrin on Moon | men on the moon and satellite communications. Certainly, modern technology does have impressive capabilities. Why then is the North still plagued with problems like * |

| SLIDE NO. | DESCRIPTION | SCRIPT |
|---|---|---|
| 7. | Poor Housing | poor housing, poor health, high costs and unemployment? Why does it often seem that technology is actually causing many of the problems * |
| 8. | Reed Dryden | such as pollution? Actually the cause is not the technology itself but its application. * |
| 9. | GLP Stack | Big projects like mass production of paper or minerals require big technology But small projects. * |
| 10. | Bldg. Log House | like building good houses require small technology. The technology must be people-oriented and it must fit the natural, social, and economic environment, in which it is used. |

| SLIDE NO. | DESCRIPTION | SCRIPT |
|---|---|---|
| 11. | Map of Ontario | In short, Northern problems require Northern solutions. This will only happen when Northerner have control over their own technolog They know what local resources they c draw on and what local problems have priority. * |
| 12. | Title (music fade down) | This presentation will look at how some Northerners and others are applying technology to economic development. But only you can decide what is appropriate for your own communities. (Big pause * with music) |
| 13. | Credits (music fade up & down) (music fast fade out) | Economic development is a process which tends to increase self-sufficie cy. In general, the North needs to diversify its industry, produce more and import less. * |

| SLIDE NO. | DESCRIPTION | SCRIPT |
|---|---|---|
| 14. | Farm Scene | One of the basic elements of self - sufficiency is food production, especially with rising transportation costs. Raising your own food also offers possibilities for employment, fresher food and reduced costs. |
| 15. | Snow, cold | But, * the major problem with northern agriculture is climate. Many species have been developed for northern agriculture and greenhouses offer a solution for others like tomatoes. |
| 16. | Ponask's greenhouse | * George Ponask's greenhouse in northern Manitoba beats the weather year round by creating an artificial climate on the inside. It supplies fresh fruit and vegetables to several communities. |
| 17. | Algas greenhouse | * This greenhouse in Alberta gets its climate from a pipeline engine's waste heat |
| 18. | Diesel Shack | * Lots of similar waste heat is available from diesel generators, mills and other |

| SLIDE NO. | DESCRIPTION | SCRIPT |
|---|---|---|
| | | sources throughout the North. This could be used not only to heat greenhouses, but also to dry lumber or do any one of a number of other jobs. |
| | | * |
| 19. | ARK | The Ark greenhouse on Prince Edward Island is designed to trap the sun's heat efficiently. The sun provides virtually all the heat required. |
| | | * |
| 20. | Storage Tanks | The heat is stored in these water tanks during the day and released at night. The tanks perform double duty because they are also used to raise fish. Of course, fish don't have to have heated tanks. |
| | | * |
| 21. | Fish Farm | They can also be raised in ponds like these in Hong Kong. (short pause) Another major agricultural problem faced by the North is lack of good land. |
| | | * |

| SLIDE NO. | DESCRIPTION | SCRIPT |
|---|---|---|
| 22. | Raspberries | However, some crops like wild rice and berries already grow there and could be cultivated and processed in the north. |
| | | * |
| 23. | Gibson Cranberry Marsh | That's exactly what's happening on the Gibson Indian Reserve near Toronto, where cranberries are grown in this marsh. |
| | | (pause) |
| | | Another good use for poor quality land is the raising of foraging animals for milk, meat or fur. Cattle, sheep and pigs are standard, |
| | | * |
| 24. | Goats | but goats, like these near Timmins show promise for the north. Reindeer are herded successfully in northern Europe and Asia and highland cattle and buffalo are other possibilities. Animals can also do a lot of useful work. |

| SLIDE NO. | DESCRIPTION | SCRIPT |
|---|---|---|
| 25. | Horse Ploughing | * Due to high cost of fuel, equipment, and fertilizers, many southern farmers are returning to animals such as horses, mules and oxen. * |
| 26. | Horse Hauling Logs | Draught animals can do many other jobs such as skidding and hauling logs, pulling wagons, lifting heavy things... * |
| 27. | Oxen/road grader | and building roads. They burn local fuels and their manures are very valuable as fertilizers to help reclaim poor land. |
| 28. | Stove/Lite | Manures and other wastes like sewage and garbage can also be processed to produce methane, a gas similar to propane. * It can be used for heating, cooking, lighting, and running engines. There are many other energy sources available in the North which could be used to replace expensive imported fuels. * |

| SLIDE NO. | DESCRIPTION | SCRIPT |
|---|---|---|
| 29. | Woods | Wood is abundant and is already burned for heat. But, wood can also be made into methane or alcohol. Unfortunately the alcohol isn't the type you can drink but, it can be used as transportation and heating fuel. * |
| 30. | Bracebridge | We also have abundant resources for generating electricity. This small station, near Toronto, provides power to a town of 5,000 people with no dam . * |
| 31. | NASA Wind Mill | Wind is abundant in some parts of the North. This windmill could supply a whole community but smaller, family-size units are also available. * |
| 32. | Thermal Station (Graphic) | Any fuel can be burned to make steam which drives an electric generator. This thermal generation process also produces a lot of waste heat which can be used to heat buildings, or greenhouses. But what fuels can we use? Wood and garbage have been mentioned, * |
| 33. | Peat Bog | but, the north also has a lot of muskeg and under it is black muck called peat. This bog in Scotland shows how Europeans have been digging peat for centuries to heat their homes. They are now also using it to generate electricity. (pause) * |

| SLIDE NO. | DESCRIPTION | SCRIPT |
|---|---|---|
| 34. | Fuel Tanks | There are many locally available energy sources in the north. It makes sense to use them. Not only can they solve the imported fuels' price and availability problems, but they also create employment and most are renewable.<br><br>Of course, the cheapest source of energy is not requiring it at all.<br>* |
| 35. | Passive Solar (Long Dog) | Northern building design could be improved a lot with features like better insulation and more use of heat from the sun. Solar energy can be as simple as a south facing window with shutters like this lumber kiln under construction in Long Dog Lake,<br>* |
| 36. | Active System | or as complex as this active system with collectors, tanks, pumps, and plenty of piping. However, improved northern housing requires better materials and more use of local materials. Logs are an excellent example but many other materials are available.<br>* |

| SLIDE NO. | DESCRIPTION | SCRIPT |
|---|---|---|
| 37. | Mud Plaster | For example, this house in Iran uses the best of traditional and modern. Building blocks are of a simple soil cement, the plaster is basically mud, and the tiles are locally made. * |
| 38. | St. Thomas Church | This church near Toronto was built in 1841 of rammed earth reinforced with straw. Certainly there can't be any question of <u>its</u> durability. * |
| 39. | Winchester Cathedral | Some of Man's most impressive and enduring structures like Winchester Cathedral, are made of stone. Even more impressive are Roman structures built some 2000 years ago, * |
| 40. | Pompeii | like this stone road and brick buildings. Most of the North has stone and the materials to make cement and bricks often are readily available. * |
| 41. | Brick Kiln | This kiln, also in Iran, shows that small scale brick making is not complex. (pause). * |

| SLIDE NO. | DESCRIPTION | SCRIPT |
|---|---|---|
| 42. | Anne Hathaway's House | Grass roofs are generally considered to be the ultimate in primitive housing but this house in England is at least 350 years old which shows that thatch can be very durable. Thatched roofs also have several other advantages such as providing their own insulation. They can be made of a variety of grasses, |
| | | * |
| 43. | Water Reeds | but the most desirable is water reeds. (pause) These possibilities for housing make an important point. The choice of technology for each community depends on the resources available to it. |
| | | * |
| 44. | "Good" northern house | Using local materials to build houses does make a lot of sense. It could lower costs, avoid many transportation problems and provide employment in addition to providing improved housing. Local resources may also be used to open up many business opportunities in the north. |
| | | * |
| 45. | BTL Woodworking | Given the abundance of wood, woodworking is a natural economic development project. This is the Big Trout Lake Furniture Shop, set up to use local materials and skills. |
| | | * |

| IDE NO. | DESCRIPTION | SCRIPT |
|---|---|---|
| 6. | BTL Chair | to provide high quality furniture and cabinets for the local market. * |
| 7. | Wood Boat (F.W) | Since boats were first invented, man has made them of wood. Modern technology allows wood's usefulness to be extended by adding fiberglass, * |
| 8. | F/G Covering Boat | a simple, labour intensive technology, which has much to offer, especially for large or odd shaped objects like boats, tanks, plumbing fixtures, etc.. (pause) * |
| 9. | Dead Vehicles | Scrap metal is another abundant resource which immediately points out the need for repair facilities. No technology is appropriate if repairs are not available. However, some scrap will always be inevitable and it can be recycled by melting it down. * |
| 0. | Afghan Foundry | done in as is being this simple foundry in Afghanistan which produces parts such as, * |
| 1. | Stoves - Afghan | wood stoves, and pots and pans. A foundry suitable fuel is charcoal which is made rather simply by partially burning |

| SLIDE NO. | DESCRIPTION | SCRIPT |
|---|---|---|
| | | wood in a closed container. * |
| 52. | FT. William Blacksmith | Charcoal also powered the Blacksmithy at Old Fort William. In the early 1800's it produced and repaired metal parts. With the high cost of heat for forming and joining metals, the blacksmithy could be appropriate now in remote parts of the north. * |
| 53. | Experimental Drum Stove | Certainly many metal products like this experimental cookstove/oven/heater with good efficiency and durability are needed in the north and could be made locally. (pause) * |
| 54. | Potting | The north also has vast amounts of clay, some of good ceramic quality. This could form the basis of a ceramic business to provide china to the local and southern markets. * |
| 55. | Weaving | Many of the more traditional crafts could be extended into new projects such as fur farming and animal and bird raising. This could include fur clothing, down clothing and equipment, weaving and others. * |

| SLIDE NO. | DESCRIPTION | SCRIPT |
|---|---|---|
| 56. | Fox Farm | Feed for farmed animals, like these foxes in Manitoba could be trash fish and cleanings from commercial fishing operations. |
| | | * |
| 57. | Ice Cutting | Commercial fishing is a well established export industry in the North. Technology shows some promise of improving its profitability with attention given to ice harvesting, ice house design and fish processing. |
| | | * |
| 58. | F.W. Brick Oven | Many other aspects of food processing offer possibilities. Modern bakery equipment is operated on fossil fuels but the old brick oven, such as this one in Fort William, can be fired on wood. |
| | | * |

| SLIDE NO. | DESCRIPTION | SCRIPT |
|---|---|---|
| 59. | Pop Cans | Pop is consumed in large quantities in many communities which leads to several problems. However, the major ingredient in pop is water, which is found in great abundance throughout the North. |
| | | * |
| 60. | Pop Shoppe | Local bottling offers the potential to solve these problems. The ready availability of small scale bottling technology is indicated by the fact that it is even franchised! (pause) |
| | | * |
| 61. | Large Mine | The land itself offers many other possibilities, including some for export industries. In Ontario, usually, only large mineral deposits are exploited but, in many parts of the world, small mines are common. |
| | | * |
| 62. | Small Mine | These can be worked from the surface with little environmental damage and show great promise for future profitability and employment. |
| | | * |

| SLIDE NO. | DESCRIPTION | SCRIPT |
|---|---|---|
| 63. | Castagne's | Rock shops like this are the fastest growing business in North America. Northerners, with their mineral wealth could be supplying them with many rock and fossil samples. |
| | | * |
| 64. | Rock Samples | Jewelery and souvenirs could also be manufactured from locally occurring minerals. (pause) The advantages of such local industries are obvious. They create employment directly and provide needed services, often at lower cost than imported goods. They allow goods and services to be tailored to local needs, allow for local control and help give individuals and communities a sense of worth and purpose. |
| | | * |
| 65. | DC-3 (?) | Nonetheless, the North will always have to import some goods, but the costs and other problems related to the present transportation system are a major drain on the Northern economy. In our search for better alternatives, |
| | | * |
| 66. | T#9 CANOES | let us begin with the North's historical highways, the lakes and rivers. |
| | | * |
| 67. | Sternwheeler | Sternwheelers such as this were used on many river systems in North America. They had a very shallow draft and ran on wood cut on the river banks. Their modern counterpart is the Jet Boat. |
| | | * |

| IDE NO. | DESCRIPTION | SCRIPT |
|---|---|---|
| 68. | Jet Boat | Using the same principle as the jet airplane, the jet drive is a self-contained unit with no propellor, no rudder, nothing to foul on rocks. |
| | | * |
| 69. | Fast Water | Mounted in a flat bottom boat, it can navigate all but the most extreme water. For that, several possibilities present themselves. Locks, flumes and marine railways are possible but somewhat expensive. |
| | | * |
| 70. | Alligator | This "Alligator" was developed to haul log booms. When it wanted to cross portages, it simply winched itself across with a cable. |
| | | * |
| 71. | Hydrofoil | The hydrofoil is another strange modern craft. It actually rises out of the water and flies on wings mounted under it. The Russians use many, like the shallow draft Kometa model shown here to transport freight on Siberian rivers. (pause) |
| | | * |

| SLIDE NO. | DESCRIPTION | SCRIPT |
|---|---|---|
| 72. | Sailing Ship | For power on the water, we should also reconsider a method of utilizing the wind which is older than even the windmill! If only as an auxiliary, the wind could save significant quantities of imported fuels. (pause) |
| | | * |
| 73. | Centennial Park | Numerous possibilities also exist for land transportation. Narrow gauge railroads like this one salvaged from a logging camp are usually cheaper to build than all-weather roads. |
| | | * |
| 74. | Tracks | Ties are available locally and rails and rolling stock may be found in many abandoned mines and other facilities throughout the North. |
| | | * |
| 75. | ATV | The all-terrain vehicle can be teamed into a train for hauling freight. It can cross anything from muskeg to hard ground and some models can ford water 4 feet deep. But our real wish is still for a <u>true</u> all-terrain vehicle, that <u>can</u> cross anything. |
| | | There are, in fact, several. The airplane is one, |
| | | * |

| SLIDE NO. | DESCRIPTION | SCRIPT |
|---|---|---|
| 76. | Goodyear Blimp | but TV watchers will also recognize the Goodyear Blimp. This one is mainly for advertising but the rigid airship is currently receiving a lot of attention as freight vehicle. |
| | | * |
| 77. | Hovercraft Graphic | The hovercraft is another all-terrain child of modern technology. It floats over the ground on a cushion of air so it can cover almost anything including water, snow, ice, muskeg, hard ground and scrub brush. |
| | | * |
| 78. | SRN-4 | This British Hovercraft, the world's largest, can carry over 400 passengers and 50 cars in regular ferry service between England and France. |
| | | * |
| 79. | Don Plemmel | Rising energy costs are making all forms of transport expensive. Air is very energy intensive and can only use relatively sophisticated fossil fuels. |

| LIDE NO. | DESCRIPTION | SCRIPT |
|---|---|---|
| | | Some of these alternative forms of transportation may be able to lower costs and offer employment, local control, and greater capacities. (pause) |
| | | * |
| 80. | Sunset | We've looked at different ways people have approached agriculture, business, housing and transportation: ways that might work in the North. The difficulty with this kind of presentation is that it is too short to do anything but scratch the surface. But what is clear is there are so many economic development opportunities in the North; so many possibilities for people with imagination to use the resources available to them. |
| | (music fade in and stop) | |